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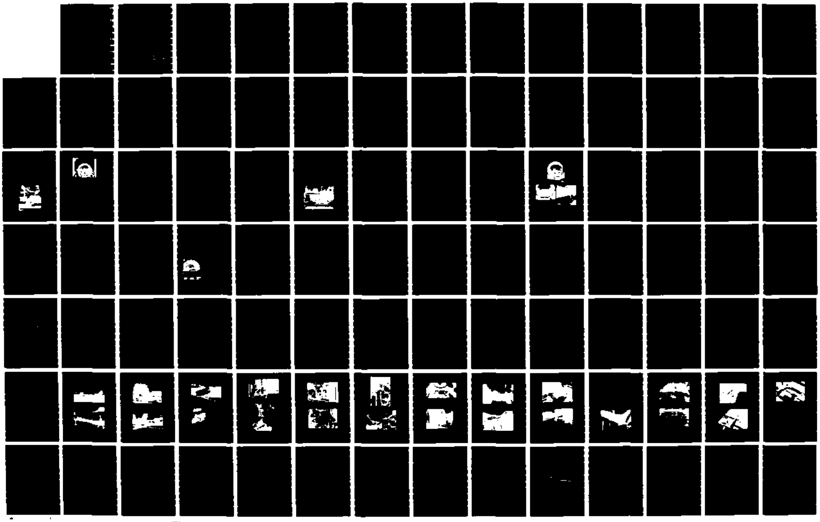

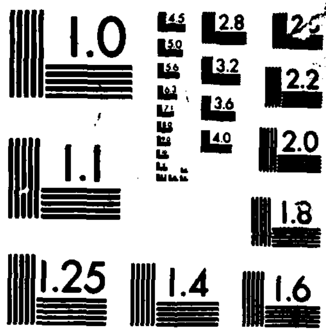

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KRASH Dynamics Analysis Modeling — Transport Airplane Controlled Impact Demonstration Test

Gil Wittlin
Bill LaBarge

Prepared by
Lockheed-California Company
Burbank, California

May 1985
(Revised March 1986)
Final Report

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U.S. Department of Transportation
Federal Aviation Administration
Technical Center
Atlantic City Airport, N.J. 08405

NOTICE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-85/9		

4. Title and Subtitle	5. Report Date
KRASH DYNAMICS ANALYSIS MODELING - TRANSPORT AIRPLANE CONTROLLED IMPACT DEMONSTRATION TEST	May 1985 (Revised March 1986)
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
G. Wittlin, W.L. LaBarge	LR 30776

9. Performing Organization Name and Address	10. Work Unit No.
Lockheed-California Company Burbank, CA 91520	
	11. Contract or Grant No. DTFA03-84-C-00004

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. Department of Transportation Federal Aviation Administration Technical Center Atlantic City Airport, NJ 08405	Final Jan. 1984 - Sept. 1984
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

A transport airplane Controlled Impact Demonstration (CID) test is analyzed with program KRASH. Prior to modeling the test condition, supporting analysis of both narrow-body and wide-body transport airplane frame segments were modeled with KRASH and compared to existing test results. The results of the analysis are utilized as input data for the KRASH CID model. Prior to the CID test a narrow-body transport airplane was impacted with the ground, via a free fall drop, to obtain structure crush and damage data. KRASH modeling of this test was used to refine the CID KRASH model. The CID KRASH model is exercised to obtain anticipated floor accelerations, underside crush, fuselage forces, and deflections. All KRASH modeling is performed utilizing current enhancement features. The latest KRASH85 input-output format is described in a separate report. Contained in this report are descriptions of the following:

- Recent KRASH85 coding changes to enhance its usage
- KRASH models and results for both narrow-body and wide-body transport airplane frame section drop tests
- KRASH model and results for a narrow-body transport airplane drop test
- KRASH model and results for a CID test to be performed.
- Conclusions based on the CID pre-test analysis results

17. Key Words (Suggested by Author(s))	18. Distribution Statement
KRASH, crashworthiness, crash dynamics computer simulation, controlled impact demonstration, CID, analytical predictions transport airplane	This document is available to the U.S. public through the National Technical Information Services, Springfield, VA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price*
UNCL.	UNCL.	173	

* For sale by the National Technical Information Service, Springfield, Virginia 22161

FOREWORD

This report was prepared by the Lockheed-California Company, under contract DTFA03-84-C-00004, sponsored by the Federal Aviation Administration Technical Center. This report describes the analytical modeling effort performed from January 1984 through September 1984. The latest KRASH input-output format incorporated during the same time period are described in report DOT/FAA/CT-85-10. The work was administered under the direction of L. Neri and C. Caiafa of the FAA.

The Lockheed-California Company effort was performed by Gil Wittlin with support from M. A. Gamon and W. L. LaBarge. The Lockheed effort was performed within the Flutter and Dynamics Department.

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EXECUTIVE SUMMARY

The analysis of a Controlled Impact Demonstration (CID) test using program KRASH is described. In support of the CID test, several frame segments as well as a complete narrow-body airplane were impacted and responses such as underside fuselage crush, mass accelerations and/or reaction loads were obtained. KRASH model results were compared to the results obtained from supporting tests. The test data were used to refine the KRASH CID models. The revised KRASH models were used to predict the responses from the planned CID conditions impact. The predicted responses indicate that at the planned impact condition the floor peak vertical accelerations will vary from 8 to 12 g's throughout the length of the passenger floor, and that the fuselage underside crushing magnitude and distribution will be approximately the same as was noted in the supporting narrow-body full airplane impact test. Similarly, the predicted response indicates that the peak longitudinal acceleration range between 3 to 6 g's throughout the cabin floor under the same impact condition. The airframe structural integrity as depicted by the fuselage moment/shear distribution was shown to be marginal at the wing center section and satisfactory at the other locations.

Improvements were made to the KRASH coding. A KRASH85 release has been documented in report DOT/FAA/CT-85/10.

SECTION 1

INTRODUCTION

1.1 BACKGROUND

The major domestic transport airplane manufacturers, under FAA and NASA sponsorship, reviewed jet transport accidents for the period 1959 to 1978. The results of these studies are presented in references 1, 2, and 3 and are summarized in reference 4. The data contained in these reports form the basis for developing candidate crash scenarios for FAR 25 narrow- and wide-body jet powered transport (reference 5) category airplanes. Analytical modeling of transport airplanes crash scenarios has been performed previously (reference 6). However, insufficient test data were available to validate the results of that study. To fully evaluate the appropriateness of crash scenarios for design considerations, it is necessary to predict airframe structure dynamic responses with a reasonable degree of accuracy. To achieve confidence in analytical procedures, it is necessary for predictions to compare favorably with test data. Where predictions differ from test data it is important to identify changes in modeling techniques and/or applied methodology. Program KRASH, developed under U.S. Army (reference 7) and FAA (reference 8) sponsorship, is used in this study to determine airframe response for an impact test involving a narrow-body jet transport.

1.2 PROGRAM OBJECTIVE

The major objective of this effort is the development of modeling techniques for future application to a wide range of impact conditions. The overall task effort flow diagram is shown in figure 1-1. The thrust of the effort described in this report is the application of program KRASH to a Controlled Impact Demonstration (CID) test involving a narrow-body jet transport airplane. Frame segment tests, as well as a preliminary narrow-body airplane impact test, provided quantitative and qualitative data which were useful in assessing the KRASH

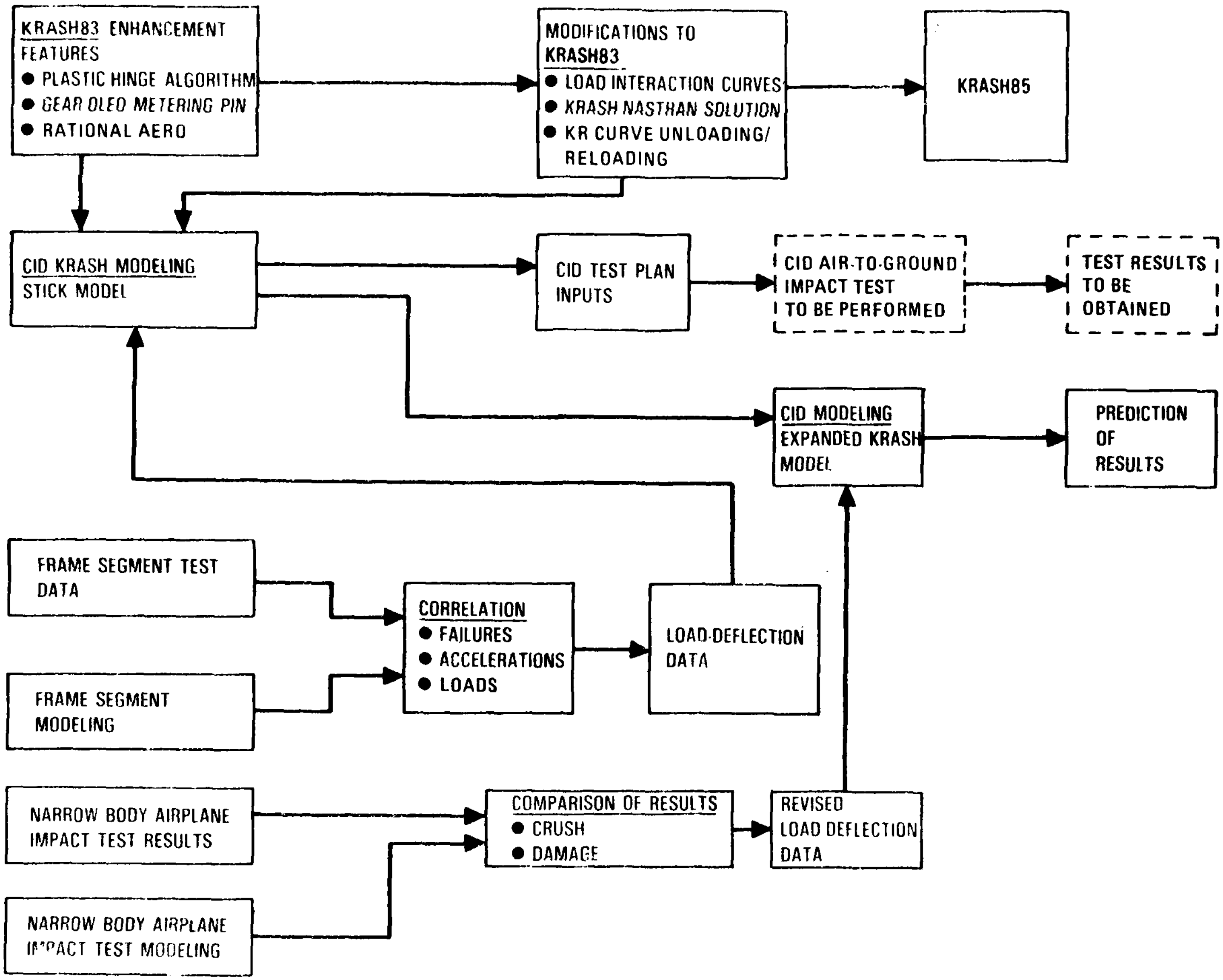


FIGURE 1-1. TASK EFFORT FLOW DIAGRAM

models and methodology. The Task effort involved the use of updated features of KRASH85 as they became available. The comparison of results and potential modifications to KRASH or the modeling techniques are to be included in a subsequent Task effort.

SECTION 2

KRASH ENHANCEMENTS

2.1 BACKGROUND

KRASH79 was released to the public after having been validated under FAA sponsorship (reference 8) for general aviation airplane modeling application. A summary of modifications, incorporated into KRASH79, is provided in table 2-1. Subsequent to KRASH79 release, additional enhancement features were incorporated into the program. This updated version designated KRASH83 was provided to the FAA at the onset of the study described in this report. A summary of these features is provided in table 2-2. In addition, several improvements were identified to be incorporated into KRASH during the course of the current effort. These features are shown in table 2-3. The more significant improvements to create the current KRASH85 version are briefly described in the following section and in detail in reference 9.

2.2 KRASH85 MODIFICATIONS

2.2.1 Revised Plastic Hinge Moment

This feature corrects a deficiency in the previous KRASH79 coding involving unloading of an element when the plastic hinge option was used. The plastic hinge coding now properly models unloading and reloading, allowing the formation of hysteresis loops representing the growth of element strain energy during cyclic loading. Figure 2-1 illustrates typical hysteresis loops obtained in KRASH85 for a test case that forces cyclic bending of a plastic hinge beam. This change provides an alternative to the use of the stiffness reduction factor (KR) tables when modeling nonlinear bending. The KR table formulation was not sufficiently rigorous to guarantee that negative values for strain energy (which is not physically possible) will not occur. This capability is

TABLE 2-1. PREVIOUS MODIFICATIONS TO PROGRAM KRASH (REFERENCE 8)

- Sloped impact surface (rigid or flexible)
- Cabin volume change
- Member directional stress
- Element linear stiffness computations
- Nonlinear curve computations
- Member frequency, yield forces and loads computations
- External spring force and compression data
- Separation of crushing and friction energy
- Symmetrical airplane modeling
- Massless node representations
- More stable stiffness and damping formulation
- Flexible ground
- Unsymmetrical axial load-deflection curves, including deadband allowance
- Expanded beam end-fixity combinations
- Plastic hinge element
- Shock strut element
- Expanded force and deflection for rupture of beams
- Energy tolerance cutoffs
- Mass impulse calculations
- Low-pass filtering of acceleration data
- Beam structural damping forces
- External spring damping
- Increased program size to 150 beam elements and 180 beam nonlinear degrees of freedom
- Mass location plots
- Acceleration pulse input
- Restart
- Summaries
  - (a) beam element rupture and yield
  - (b) external spring loads and deflections
  - (c) plastic hinge occurrence
  - (d) time history plots of mass responses and impulses, beam forces, deflections, stresses, strain energy and damping energy, external spring force and deflections, occupant DRI's, and cg translational velocities.

TABLE 2-2. THE FEATURES UNIQUE TO KRASH83

- Revised plastic hinge unloading/reloading algorithm (eliminates instabilities caused by coupled bending motions with KR coding)
- Inclusion of metering pin in oleo model
- Saving of mass displacement data for post-processing
- Addition of rational aerodynamic force/moment calculations for each mass
- Provision for input of force or moment time histories for each mass
- Addition of label cards in input format
- Provision for overriding run termination due to energy growth
- Revised input and output formats to accommodate additional features
- Corrections of minor coding errors
  - Elimination of DRI mass from cg velocity calculation
  - Corrections of plot array dimension errors in PREPLOT
  - Corrections in GENMOD for acceleration input tables
  - Correction of internal beam lateral deflection print/plot output
  - Provision for user input specification for vertical beams
  - Capability to run case with NSP = 0, no external springs
  - External spring load truncation altered to avoid premature cutoff

TABLE 2-3. KRASH85 ENHANCEMENT FEATURES

	Modification
o	Expand IC subroutine to compute balanced beam loads (interfaces with NASTRAN)
o	Provide for failure criteria based on approximate combined loading
o	Recode energy balance to include effects of input forces or accelerations for specified masses
o	Correct KR unloading/reloading so that loads are limited in both directions (uncoupled X, ϕ directions)
o	Calculation of CG forces, accelerations, velocities and displacements time histories
o	Develop user-independent beam orientation algorithm
o	Saving of acceleration and forces for data transmittal
o	Printout and/or plot of beam forces in mass axis
o	Addition of tire vertical spring coding
o	Compute total moment and shear distribution at any station
o	Input masses in arbitrary numbering scheme

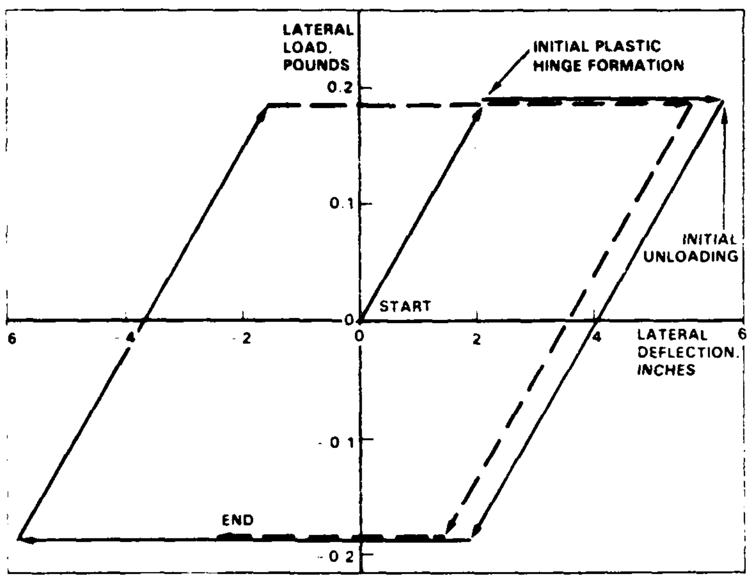


FIGURE 2-1. THE FORMATION OF HYSTERESIS LOOPS FOR LATERAL BENDING OF PLASTIC HINGE ELEMENTS FROM KRASH85

important for modeling frame segments. The program prints out a summary which provides the following information on plastic hinge moment formation:

- Beam number and end (i^{th} and/or j^{th})
- Time of occurrence
- Direction

As in the previous coding the user still identifies beams that can form plastic hinge moments by an end fixity (pinned) designation and beam shape factor.

2.2.2 Gear-Oleo Element Metering Pin

Since a metering pin is such a common feature in a transport airplane landing gear, the ability to model the varying damping characteristics is necessary to properly analyze transport airplane landing gears. This is particularly true because of the high sink rates involved in crash landings, which yield high strut closure velocities wherein the damping force is predominant. The KRASH coding has been organized so as to determine the metering pin damping versus stroke characteristics needed to match a given load-deflection curve. In effect, the program can be run in an "inverted mode," in which the user inputs a known load-deflection curve (from drop test data), and the program calculates the metering pin characteristics (damping constant versus stroke) required to achieve the input load-deflection curve. The output metering pin curve can then be used in subsequent analyses of the gear for other conditions. The feature is useful when the actual profile of the metering pin is not available, but drop test data are available. Figure 2-2 illustrates a comparison of results of test and analysis for a transport airplane main gear drop test at 12 ft/sec, using KRASH with a metering pin derived as described above. The degree of correlation evident in figure 2-2 represents an order of magnitude improvement over what was obtainable using a trial and error procedure to try to deduce the proper metering pin characteristics, without the "inverted mode" provision.

2.2.3 Load-Interaction Curves

KRASH85 includes load interaction curve (LIC) data for failure prediction. Figure 2-3 shows a typical set of interaction curves for fuselage bending and

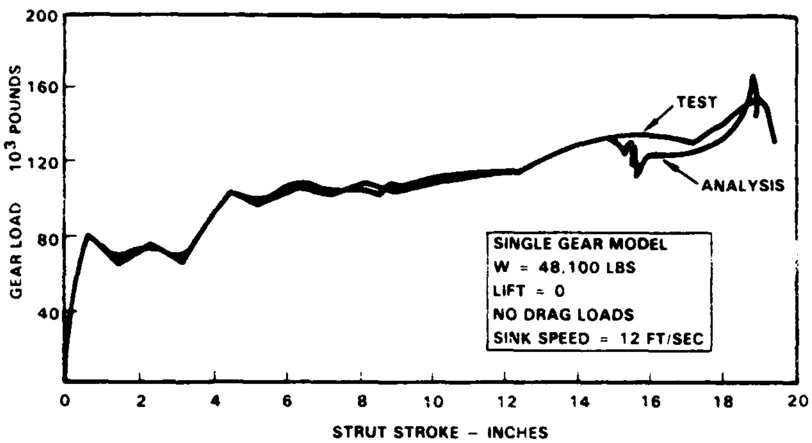


FIGURE 2-2. DUPLICATION OF KNOWN TEST-LOAD-DEFLECTION CURVE USING METERING PIN CODING IN KRASH85

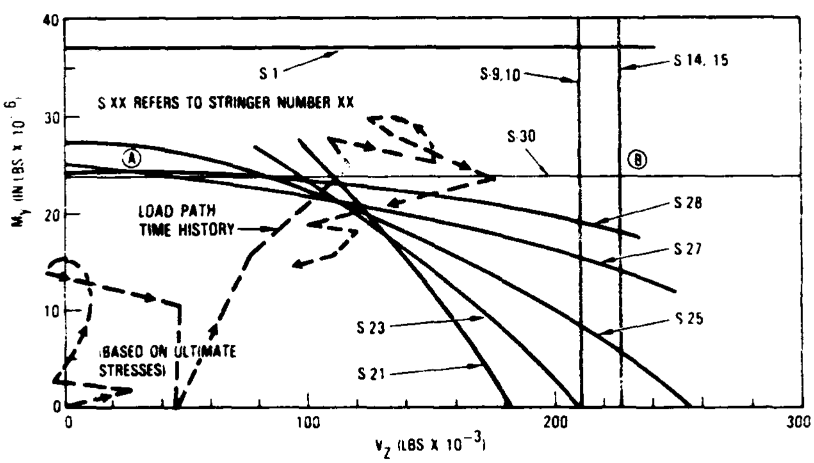


FIGURE 2-3. MAXIMUM ALLOWABLE MOMENT AND SHEAR ENVELOPE - NEGATIVE BENDING

shear at a particular airplane fuselage station. Figure 2-4 identifies the stringers at a representative frame location. The user can specify interaction curves at a maximum of 40 locations which can be anywhere. The user is not restricted to using the end points of the beam. Up to 20 straight line segments can be used to define each load-interaction curve.

At each location the program calculates the following:

- The internal beam loads, in KRASH sign convention, at the load interaction point.

  - o These loads are transformed to correspond to the standard structural load sign convention employed by the Lockheed-California Company (Calac).

  - o The Calac-convention loads are then transformed to a user-specified sign convention. One of six such sign conventions may be selected by the user. If no convention is specified, the loads are left in the Calac sign convention.

  - o The two interaction loads are selected from the six loads calculated.

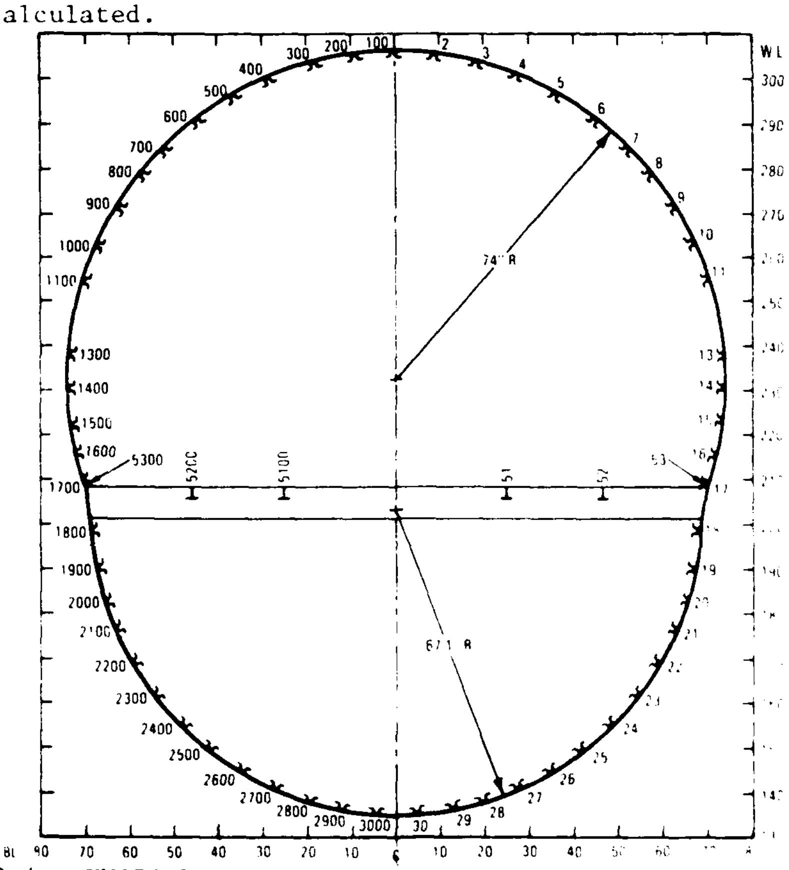


FIGURE 2-4. TYPICAL CROSS SECTION WITH STIFFENER LOCATIONS - REAR VIEW

- A load ratio for each load interaction line. A ratio greater than one indicates that a load interaction curve has been exceeded, signifying that at least one element has failed in some manner. KRASH85 is coded to allow complete rupture of a beam element if an input maximum load ratio is exceeded.

At the conclusion of the computer run the following is printed:

- Time histories of the following quantities for each load interaction curve.

  - o X Load (fuselage vertical shear in figure 2-3)

  - o Y Load (fuselage vertical bending in figure 2-3)

  - o Maximum load ratio at each time

  - o Input load interaction line number corresponding to the maximum load ratio at that time.

- A summary which shows the peak maximum load ratio for each interaction curve and the overall maximum load ratio.

The user has the option of saving the load-interaction curve time history data in an output file, which can be used for subsequent post-processing. A post-processing program has been developed (independent of KRASH85) to generate load interaction curve x-y plots. These data can be plotted to show the time-varying path of the calculated x-y loads, superimposed on the load-interaction curve (as illustrated by the dashed line in figure 2-3).

While the load interaction data output provides a great deal of useful information not previously available, considerable caution must be exercised by the user in its interpretation. A maximum load ratio greater than one does not, by itself, indicate complete failure of the corresponding fuselage section. The output data have been used in conjunction with the actual *manufacturer-furnished* interaction diagrams to assess the extent of damage at each location. For example, suppose that the computed combined loads were as shown by points A and B in figure 2-3. For point A stringers S27 through S30 could fail. For point B several additional stringer elements could fail (S-9 through S-15 and S-[illegible] through S-30). Usually the input data for running KRASH is the minimum necessary to define the inner boundary in figure 2-3. The current KRASH85 coding does not define which stringers fail.

2.2.4 Expanded Initial Condition (IC) Subroutine

The expanded IC subroutine allows for interfacing with NASTRAN (MSC version) to obtain a statically balanced set of loads and displacements. The overall flow diagram is shown in figure 2-5. For a complete analysis, including the determination of balanced initial conditions, steps 1, 2, and 3 are all executed. Each step involves a separate computer program, and the runs are performed sequentially. A single submittal is adequate to accomplish all 3 steps. The vehicle is properly balanced at time zero. The masses are deflected from their original positions to be compatible with the forces acting. The forces considered in the balance equations include: gravity, externally applied forces, aerodynamic lift, inertia relief loads, and mass accelerations.

2.2.5 Comprehensive Energy Balance Code

The energy balance equations in KRASH79 did not account for externally applied loads; i.e., force, aerodynamic lift, mass accelerations. As a result, while the total energy could deviate substantially from 100 percent, the solution was stable. However, the growth in energy caused confusion in interpreting analysis results. The effect of all externally applied forces are now accurately accounted for. Thus, growth of total energy in excess of 1 percent would be considered suspect with regard to model validity.

2.2.6 c.g. Time Histories

KRASH79 contains a summary of c.g. velocity versus time, which is plotted at the end of each run. This feature is still retained. However, KRASH85 in addition contains a summary print of the following quantities:

- Time
- External forces in x, y, z directions
- Accelerations in x, y, z directions
- Velocities in x, y, z directions
- Displacements in x, y, z directions

A cross plot of force versus deflection yields a load-deflection curve. When using KRASH85 to model a substructure; i.e., frame section, this output could be used to develop an equivalent load-deflection curve as input into a larger model.

2.2.7 Arbitrary Mass Numbering

KRASH85 accepts user supplied mass point identification numbers. The modification can be thought of conceptually as a mass point number pre-processor and a mass point number post-processor. The pre-processor converts external mass point numbers to internal mass point numbers. The external mass point numbers are supplied by the user as part of the input while the internal mass point numbers are defined by the program. The internal mass numbers are consistent with the numbering system previously used in earlier versions of program KRASH. After conversion program KRASH85 is executed using the internal mass point numbers. After execution is completed the post-processor converts the internal mass point numbers to external mass point numbers for output. In the modification, two new subroutines (INPT and INPTPL) were added. In these subroutines, two arrays (MASS and IMASS) are defined which cross reference the external mass point numbers to internal mass point numbers and vice versa.

The external mass point identification numbers are input in columns 71 and 72 on Card 200 (MASS POINT DATA). The identification numbers cannot be less than zero or greater than 99. If they are, program execution will be halted. If any of the numbers are left blank or set equal to zero, the program will automatically assign sequential identification numbers to all mass points in the order of input. This option accommodates previously developed input data sets.

When the RUNMOD=2 option is used, the program automatically assigns an external mass point identification number to the image mass point generated under this option. The identification number assigned is 100 greater than the identification number of the mass point used in defining the image mass point. For example, if the input mass point identification number is 96 then the image mass point identification number will be 196.

SECTION 3

FUSELAGE SECTION TESTS AND ANALYSES

3.1 NARROW BODY AIRPLANE FUSELAGE SECTIONS

Two narrow-body fuselage forward sections were subjected to a vertical impact. The first test was conducted at that NASA-Langley test facility. The results of the test are reported in reference 10. The Pre and post impact conditions are shown in figures 3-1 and 3-2. The 120-inch long (six-bay) specimen was subjected to a 20 ft/sec vertical velocity impact. The weight, including seats and occupant representations, is approximately 5100 pounds. A two-dimensional KRASH model was established to represent a typical frame. The post impact configuration predicted by the analytical model is shown in figure 3-3.

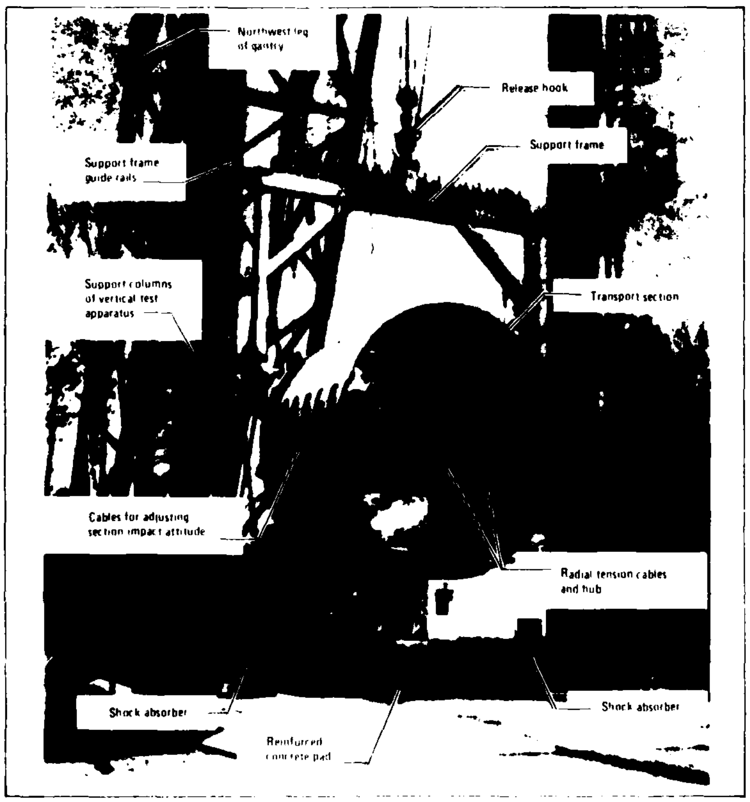


FIGURE 3-1. TRANSPORT SECTION SUSPENDED IN VERTICAL TEST APPARATUS

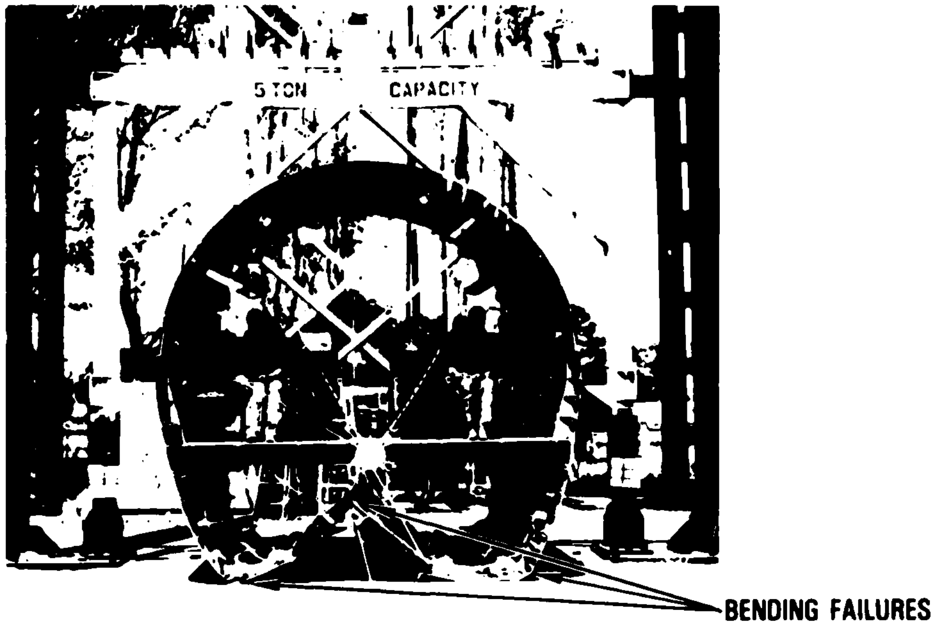


FIGURE 3-2. POST-TEST VIEW OF TRANSPORT AIRPLANE SECTION

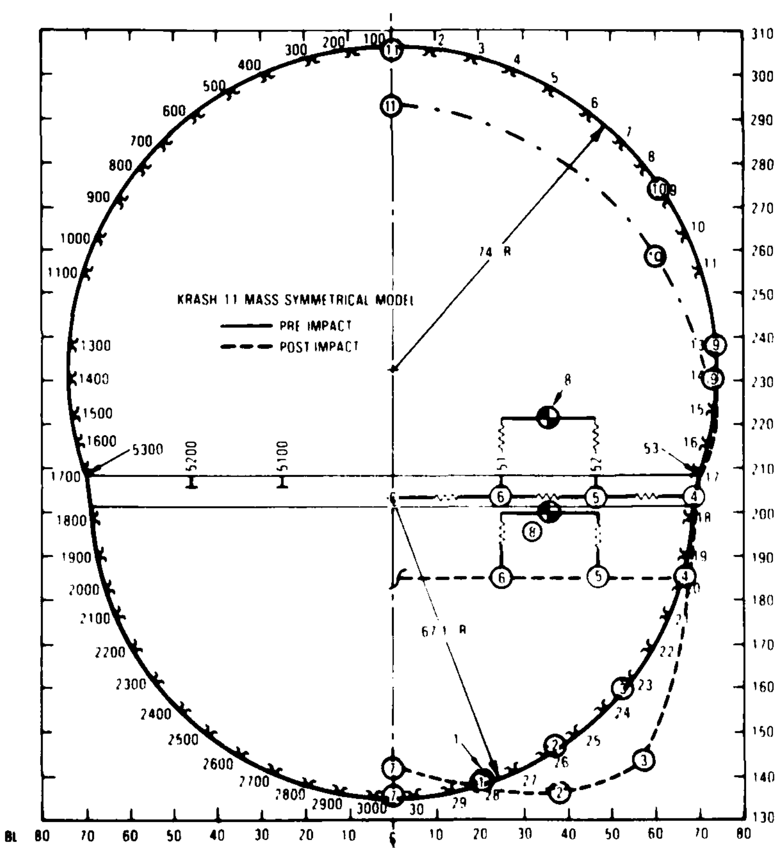


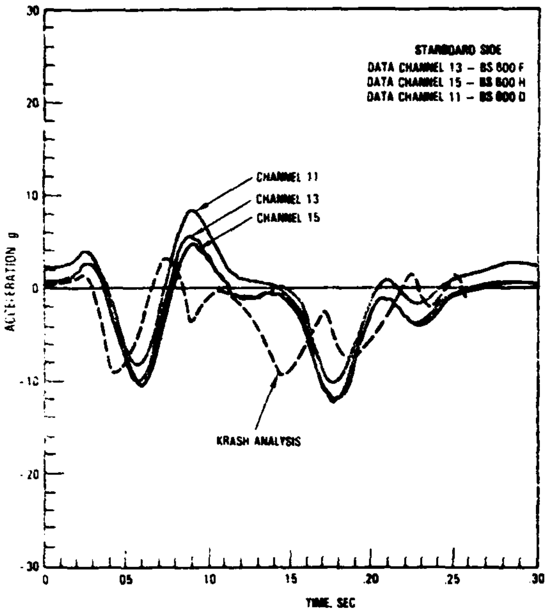
FIGURE 3-3. TRANSPORT AIRPLANE FRAME TEST SECTION AND ANALYTICAL MODEL

The KRASH symmetrical model, representing a typical frame, consists of 11 masses and 12 beams. An echo of the KRASH model is provided in Appendix A, Section A-1. The comparison of the analysis and test results is shown in figure 3-4 for three airframe and one occupant location. The KRASH model assumes that the mass associated with each frame is the same and that the weight on the port (left) side is also equal to weight on the starboard (right) side. The actual weight distribution between port and starboard sides for the test article was closer to 60/40. The frame designations for the test specimen are 600, 600D, 600E, 600F, 600G, 600H and 600J, each of which are 20 inches apart.

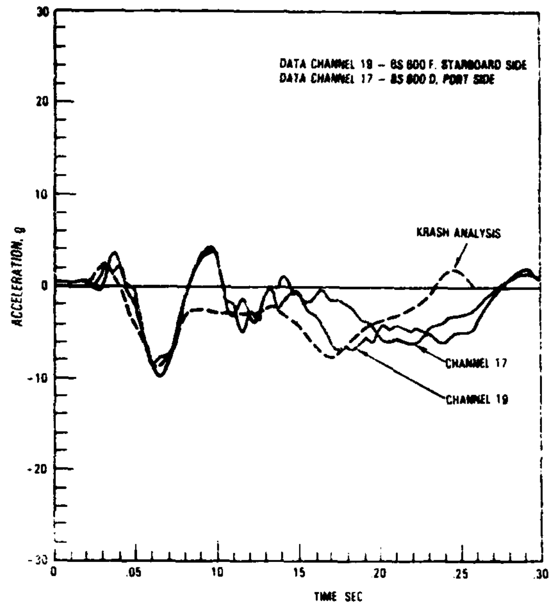
Figure 3-4 shows that for measurement locations several frames apart (40 to 80 inches), the responses do not differ substantially. The same is true when comparing starboard and portside responses (floor beam/inboard seat rail). Even the lighter mass roof peak responses, located 40 inches apart, are within 20 percent and 10 milliseconds of their acceleration and time of occurrence, respectively.

The analysis results, at all comparative locations, approximate the measured response peaks generally within 20 percent in amplitude and within 20 milliseconds with respect to the occurrence of the peak response. Thus, the representation of a single frame, while not exact at every location, approximates the segment response. This indicates that, while failure modes can vary along the length and width of the structure, a simplified representation can satisfactorily predict the responses "on the average". More detailed modeling would not necessarily predict the response more accurately or reliably and most likely would require significantly more time and computer cost. The analogy of predicting failures "on the average" for this model, is similar to the conclusions obtained in a previous study (reference 11) in which crush behavior of fuselage underfloor segments were determined, using simplified approximate procedures.

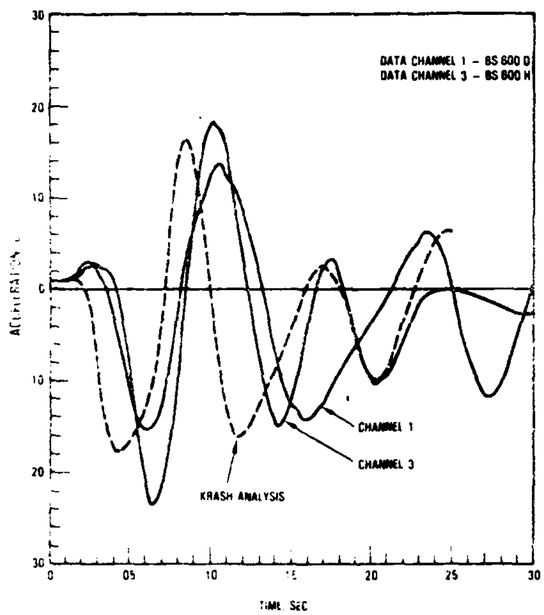
As noted earlier, program KRASH was modified to compute c.g. forces, accelerations, velocities, and displacements versus time. With this algorithm a load-versus-time deflection curve characteristic of the overall structure behavior was obtained directly from the analysis results. Since the test setup did not include load cells from which reaction loads could be measured directly, no comparison can be made for this parameter. A three-dimensional plot of the analysis generated load, deflection and time parameters is shown in figure 3-5.



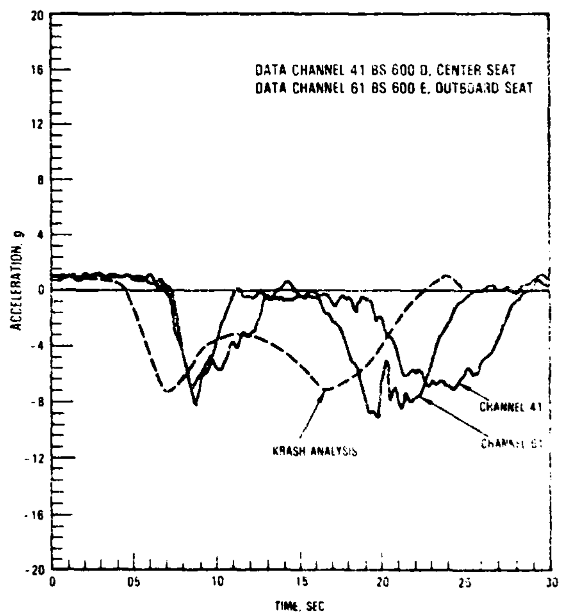
(a) Frame Floor Beam, Starboard Side



(b) Floor Beam/Inboard Seat Rail



(c) Roof



(d) Pelvis

FIGURE 3-4. KRASH FRAME ANALYSIS VERSUS TEST RESULTS

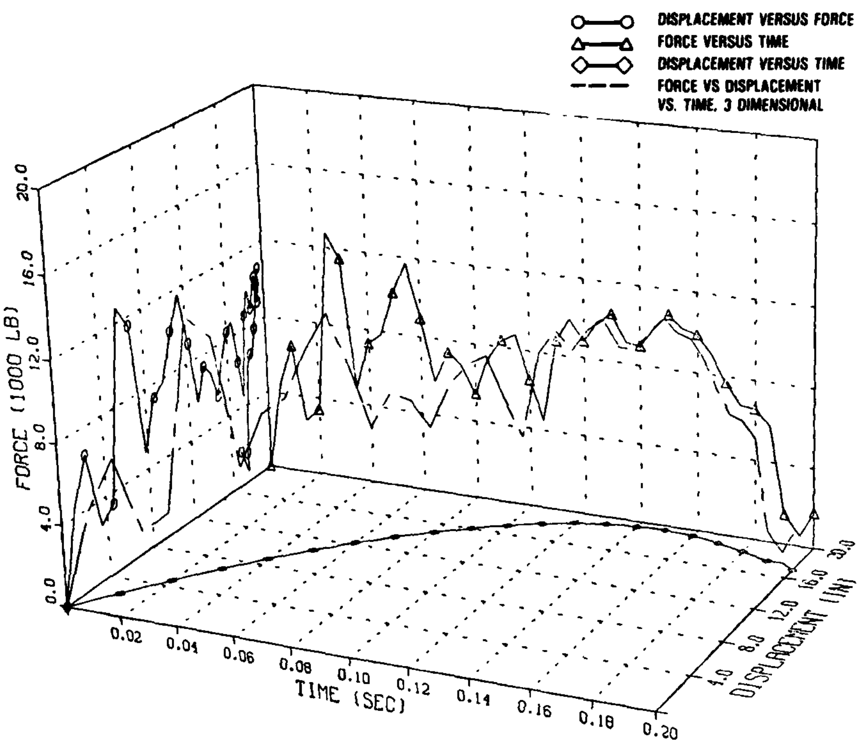


FIGURE 3-5. B707 FRAME (NO CARGO) LOAD-DEFLECTION TIME HISTORY

For inputs into a larger KRASH airframe model the load deflection curve is approximated by the dashed line in figure 3-6. The energy, as computed by the area under the load-deflection curve, agrees with the amount of energy to be dissipated based on the mass, velocity and crush distance involved. The approximately 20 inches of crush obtained in the analysis is consistent with the measured results.

The second test of a B707 fuselage section (reference 12) was performed at the FAA Technical Center test facility in Pomona, N.J. The 120 inch long instrumented, forward fuselage section was impacted at a velocity of 20 ft/sec. The section was representative of stations 460 through 580. The NASA section was representative of stations 600 through 600J. The total weight for the FAA 6 bay segment was 6440 pounds, of which 1860 pounds was cargo luggage. The post test configuration for the FAA test is shown in figure 3-7. Of interest in the FAA test, was the presence of luggage on the cargo floor which minimized the extent to which a cusp was formed at the extreme lower centerline. The KRASH representation for

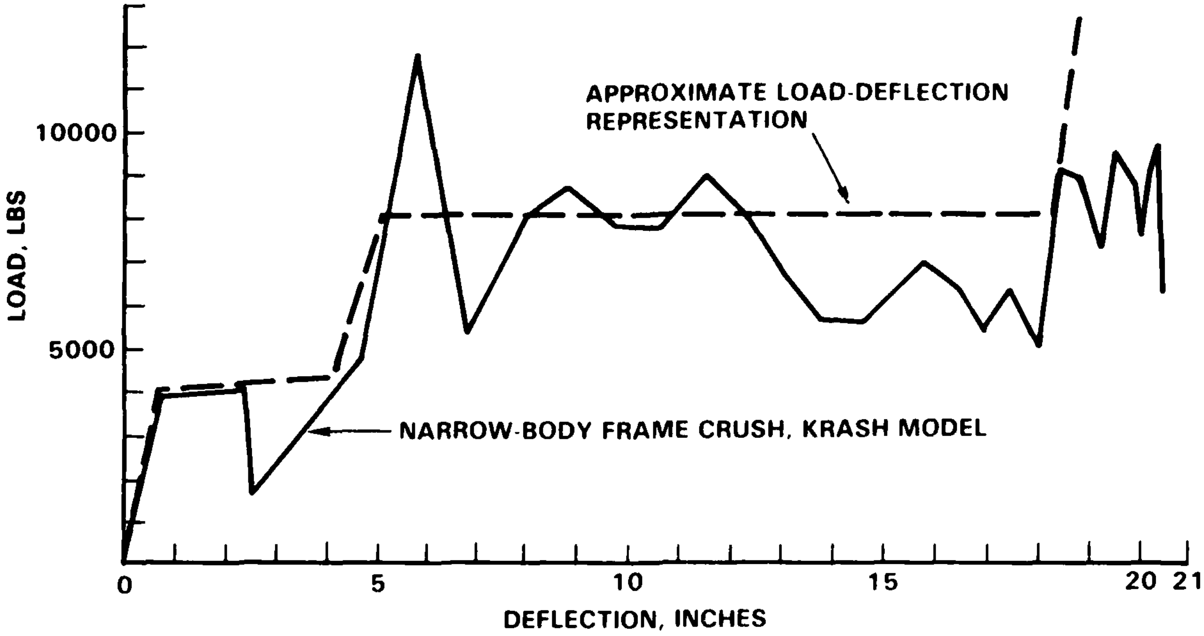


FIGURE 3-6. FRAME LOAD-DEFLECTION OBTAINED BY KRASH ANALYSIS

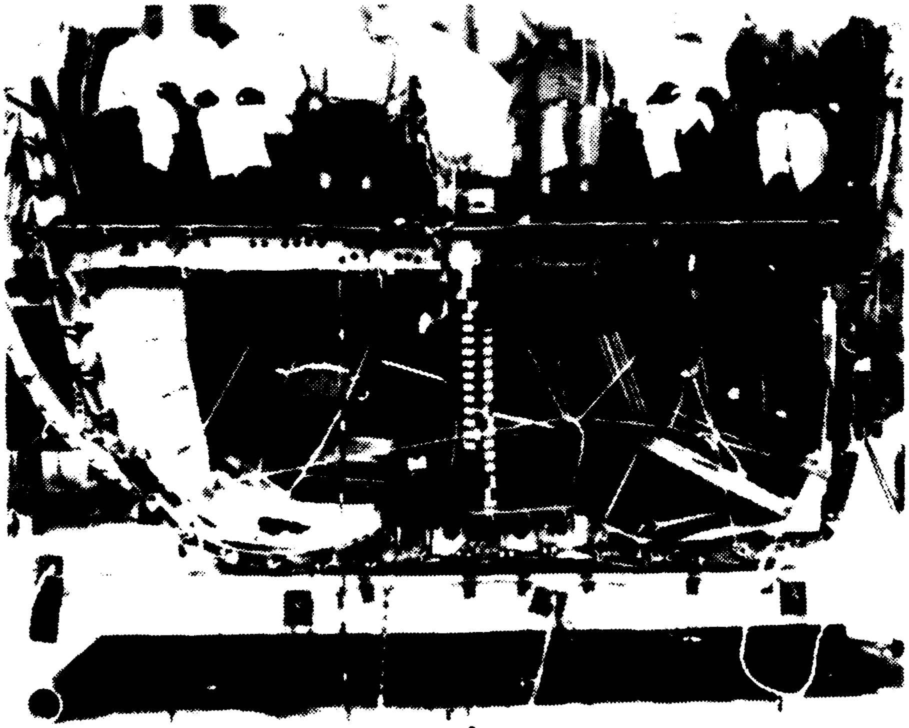


FIGURE 3-7. POST-TEST VIEW OF TRANSPORT AIRPLANE SECTION WITH CARGO

this test is the same model as shown in figure 3-3, except for added mass representing the luggage at locations 1 and 7.

The results of the KRASH analysis are compared to FAA test data in figures 3-8 through 3-11. Figure 3-8 shows the c.g. displacement versus time for analysis and test. The test data are obtained via double integration of midcenter vertical acceleration data. The peak displacements occur very close in time and differ by approximately 1.5 inches or less than 10 percent.

Figure 3-9 compares load cell force versus vertical displacement for analysis and test. The force from the analysis is based on scaling up the weight of the frame model to that of the total weight of the test article. Figure 3-10 shows the force versus time comparisons. The comparisons in figures 3-9 and 3-10 show good agreement with peak values, as well as with the time of occurrence. Figure 3-11 compares passenger floor vertical accelerations for test and analysis. The test data are from the midspan of the floor and were filtered at 60 Hz. The location for the analysis acceleration is at the inboard seat-floor attachment BL24.8 and was filtered at 50 Hz. The primary peak acceleration is within 10 percent in magnitude but occurs later in the analysis than shown in the test. The second deceleration peaks are in phase and approximately 20 percent apart in peak value. Both the test and analysis show a third peak deceleration value at 0.150 msec. The analysis peak deceleration for the third peak is -9g as compared to -4g for the test. Thereafter both analysis and test show a substantial decrease in response.

3.2 WIDEBODY AIRPLANE FUSELAGE SECTION TEST

A wide-body aft fuselage section was subjected to an impact having a 20 ft/sec vertical velocity in the same manner as were the narrow-body fuselage sections noted earlier. The weight, including one partial row of occupants, was approximately 5000 pounds. The pre- and post-impact configurations are shown in figure 3-12. The major damage was failure of the vertical supports for the cargo floor structure.

The frame model developed for use in program KRASH is illustrated in figure 3-13. It is a symmetric, half frame representation of a single bay of the DC-10 fuselage section used in the drop test. The model consists of fourteen

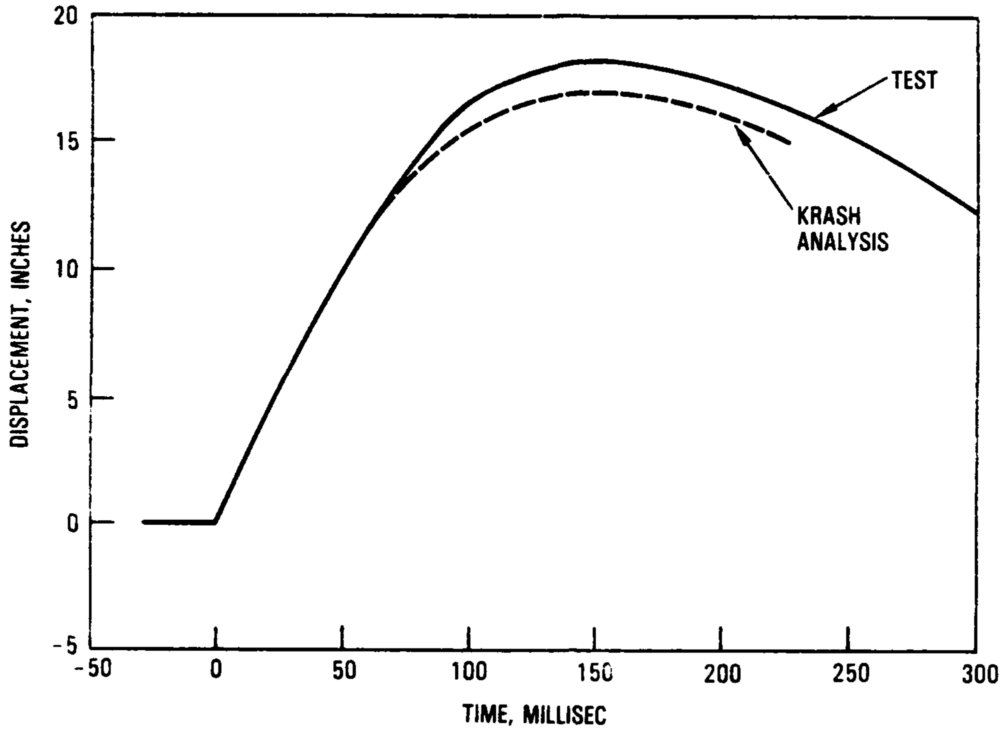


FIGURE 3-8. COMPARISON OF FAA TEST AND KRASH ANALYSIS, VERTICAL DISPLACEMENT VERSUS TIME

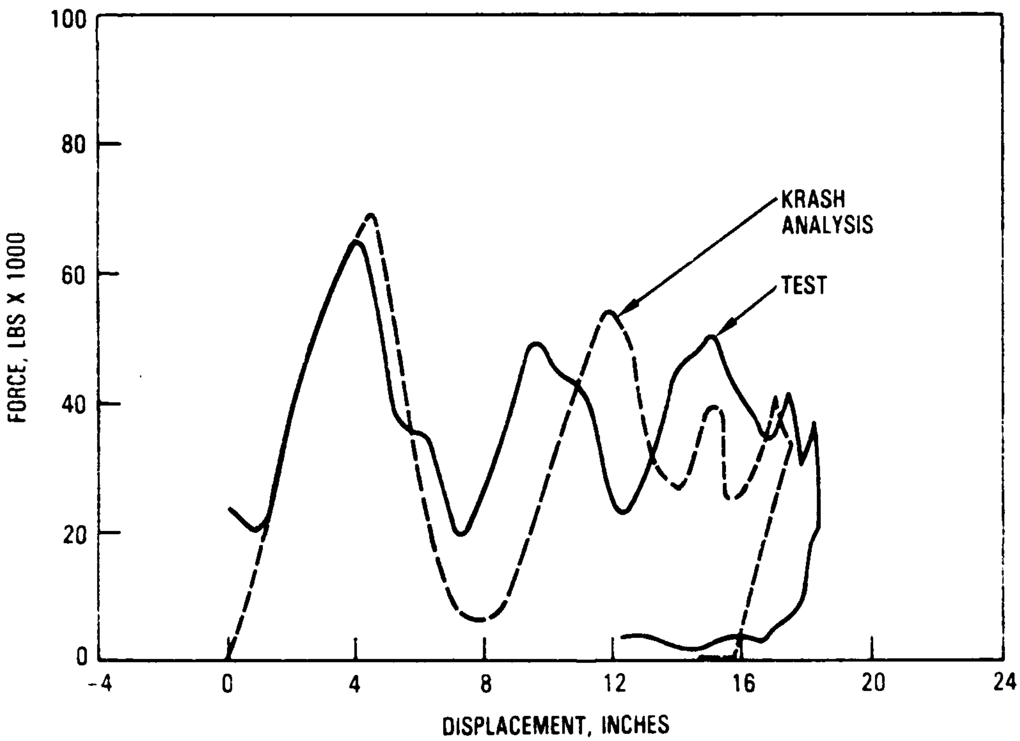


FIGURE 3-9. COMPARISON OF FAA TEST AND KRASH ANALYSIS, FORCE VERSUS DISPLACEMENT

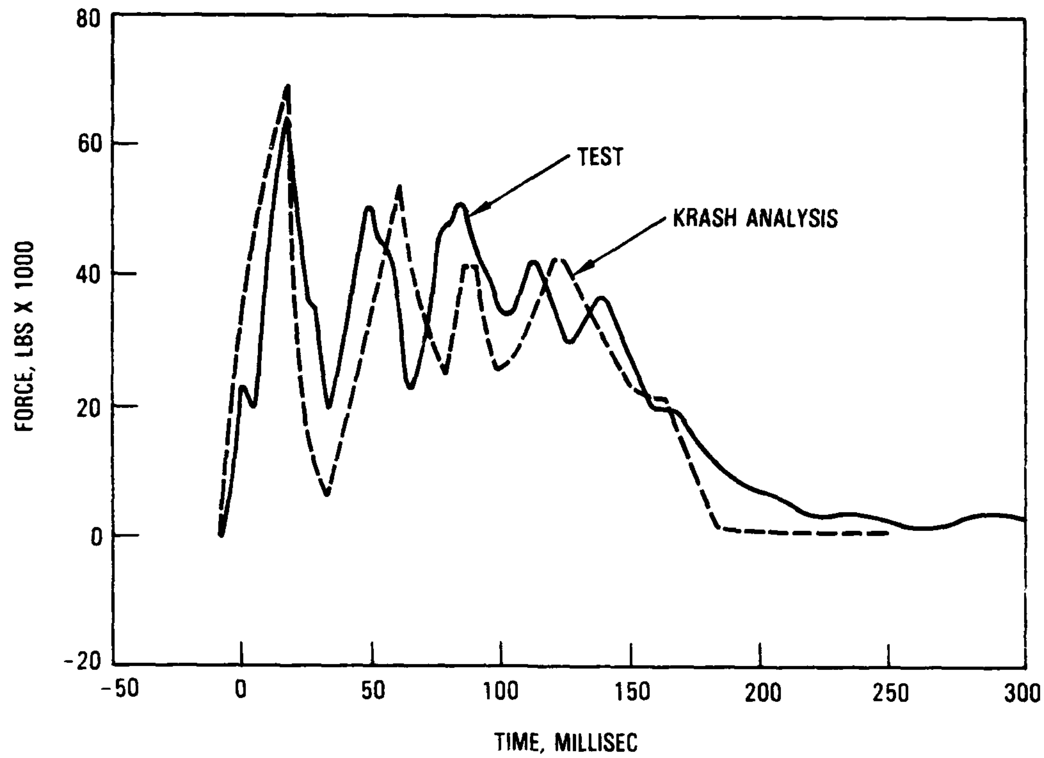


FIGURE 3-10. COMPARISON OF FAA TEST AND KRASH ANALYSIS, FORCE VERSUS TIME

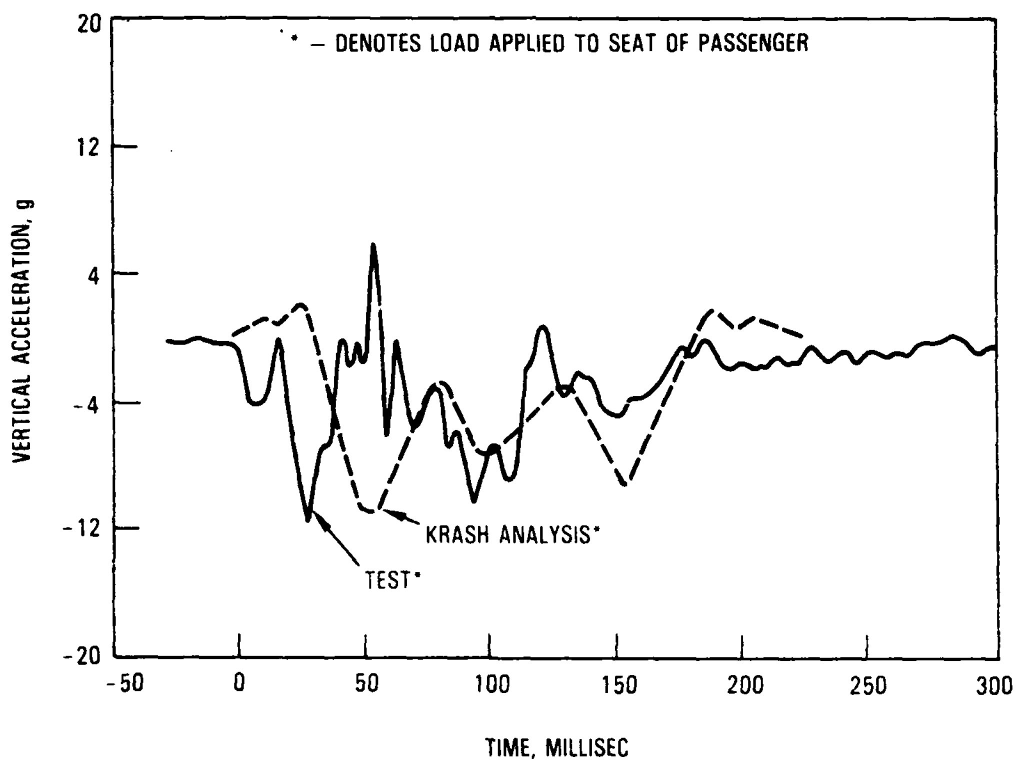
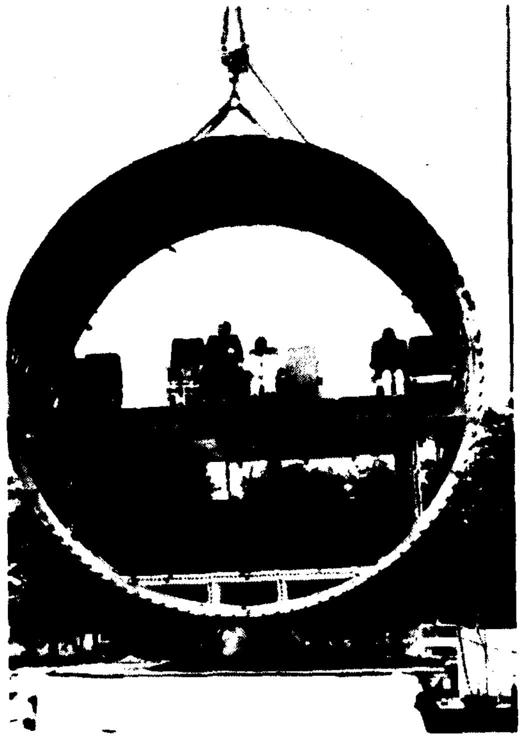
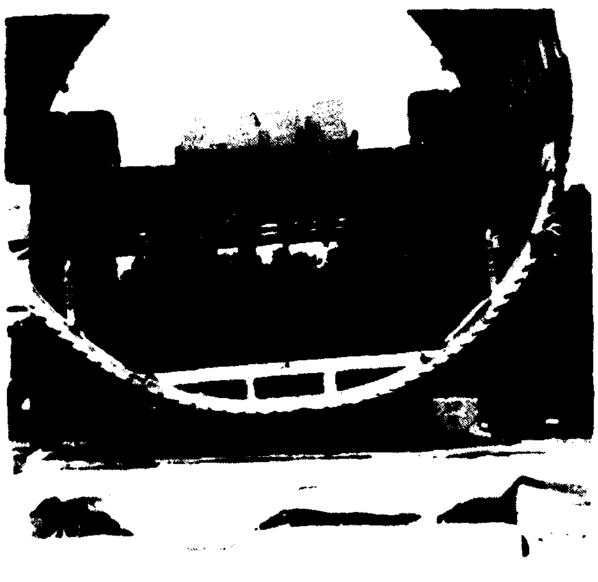


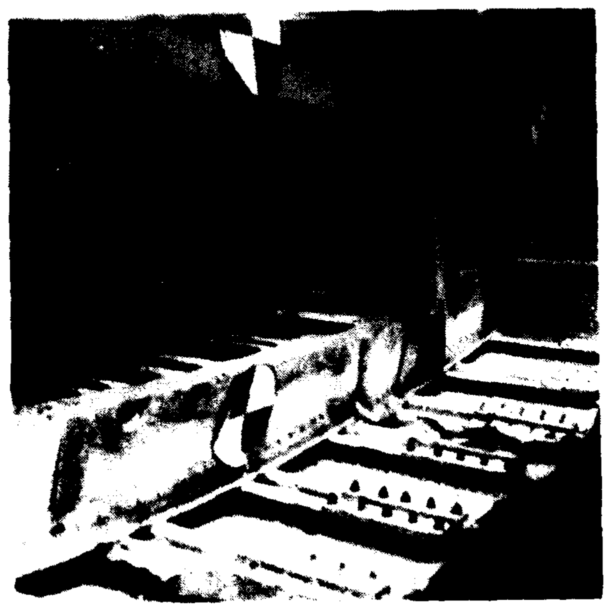
FIGURE 3-11. COMPARISON OF FAA TEST AND KRASH ANALYSIS, PASSENGER FLOOR VERTICAL ACCELERATION



(a) Pre-test



Overview



Close-Up of Cargo Floor Vertical Supports

(b) Post-test

FIGURE 3-12. DC-10 FUSELAGE SECTION TEST

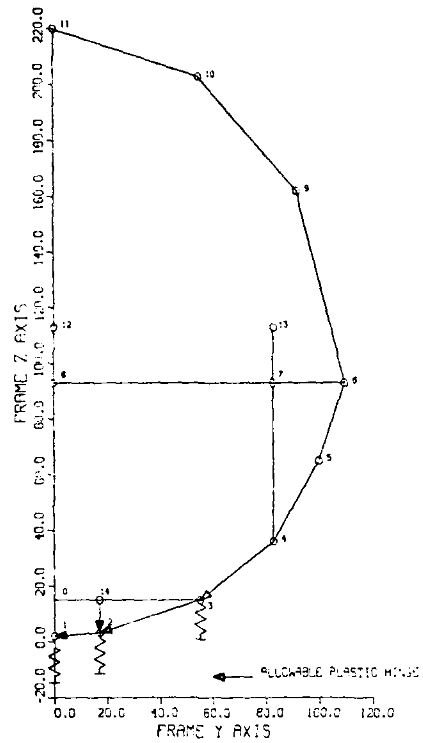


FIGURE 3-13. DC-10 FRAME MODEL

mass elements interconnected by sixteen beams elements. Three crushing springs are provided to transfer the impact load to the frame model. The frame model represents a portion of the test section with a weight of 1235.0 pounds. An echo of the KRASH frame model is shown in the Appendix, Section A-2.

Plastic hinges are allowed in the cargo floor region as noted by the arrows in figure 3-13. Plastic hinge moments are allowed about both beam y and beam x axes except for the cargo floor post (beam 2-14) for which a plastic hinge moment is allowed about the beam z axis only. Rupture produced by a moment about the beam y axis, equivalent to the allowable plastic hinge moment, is also allowed at the mass 2 end of the cargo floor post.

The frame model was used to simulate a flat (zero pitch) impact having a 20 ft/sec drop velocity. The resulting load deflection time history of the frame c.g. is shown in figure 3-14. The analysis results indicate that during the drop a maximum displacement of 6.3 inches is reached approximately 0.045 seconds after impact. A maximum load of approximately 37,000 pounds

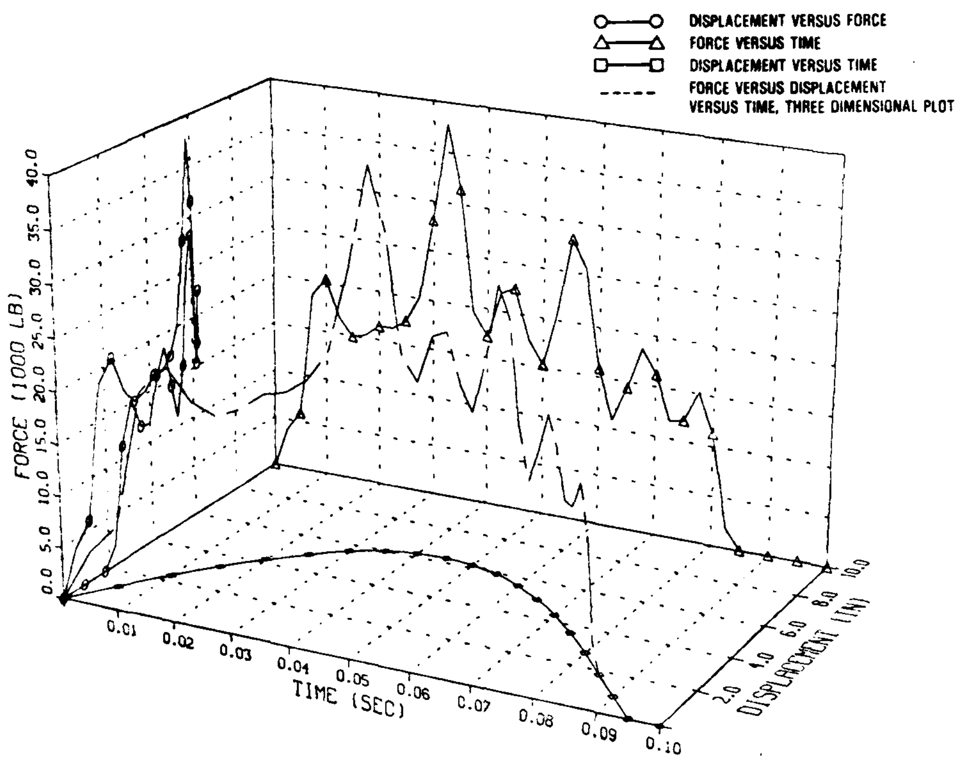


FIGURE 3-14. DC-10 FRAME LOAD-DEFLECTION TIME HISTORY

occurs approximately 0.0125 second prior to the occurrence of the peak displacement. After reaching maximum displacement, the frame rebounds and leaves the ground at approximately 0.085 second after impact.

During impact an exchange of energy takes place as shown in figure 3-15. At impact the total energy is divided between gravitational potential energy* and kinetic energy. At the time of maximum c.g. displacement all of the kinetic energy and a small percentage of the potential energy has been converted into strain energy and crushing energy. The strain energy is associated with the deflection of the beam elements and the crushing energy is associated with the deflection of the crushing springs. Note that at the time the frame leaves the ground (time - 0.085 sec) the potential energy has been restored to its original value while part of the kinetic energy has been permanently transformed into strain and crushing energy. This permanent transfer results in

*The potential energy is based on a selected reference plane.

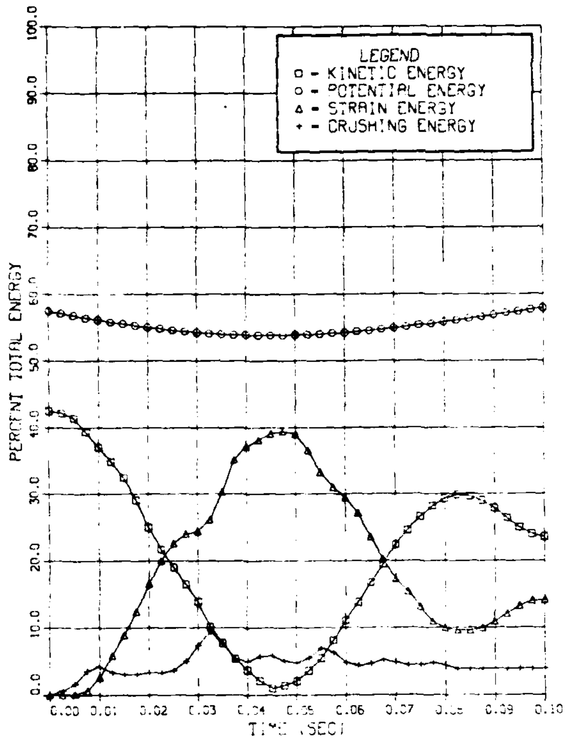


FIGURE 3-15. ENERGY DISTRIBUTION - PERCENT OF TOTAL

the plastic deformation of some of the beam elements and permanent set of the crushing springs. The resultant "permanent set" of the c.g. is approximately 1.8 to 2.0 inches.

In the time period following ground contact the structure below the cargo floor deforms. A plastic hinge is formed about the frame x axis at the attachment of the cargo floor post (beam 2-14) and the frame beam element. In addition, plastic hinges are formed at masses 1 and 3. The frame's y and z axes are defined in figure 3-13. The frame x axis is normal to the plane containing the y and z axes.

Passenger vertical acceleration time histories (masses 12 and 13) are shown in figure 3-16. Maximum vertical accelerations of approximately 33 g's and 51 g's, respectively, are experienced by the two masses. The base duration associated with the peak accelerations at the floor are < 50 milliseconds.

Data available from the test consisted of personal observations, photos, and a video tape record of the test. The analysis was performed prior to the

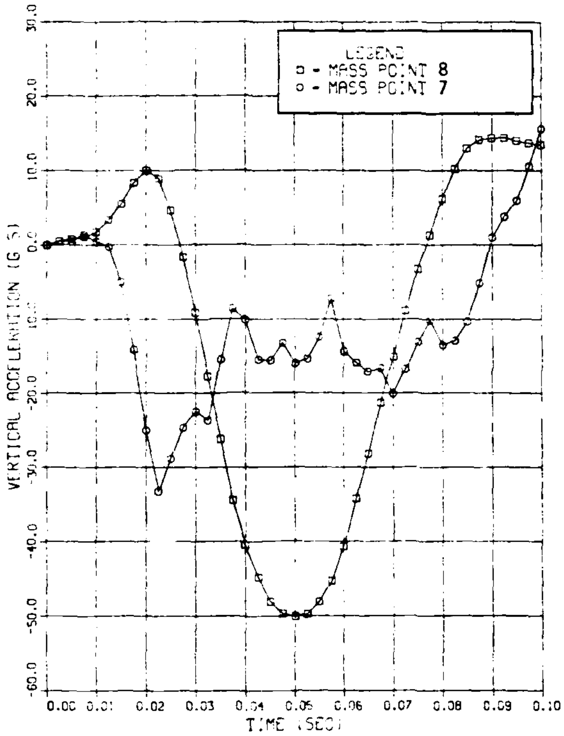


FIGURE 3-16. PASSENGER CABIN FLOOR ACCELERATION TIME HISTORY

availability of acceleration response data. A post-test inspection indicated that there was apparent damage to the regular aircraft seats. An onboard experimental seat suffered a slightly bent frame. The weight of the section is considered to be relatively light, which most likely accounts for the slight damage (all of which occurs below the cargo floor) and the high floor accelerations. Comparison of the predicted response of local structure in the region of the cargo floor with the observed post-test results reveals the following:

Predicted Results	Observed Results
Cargo floor post plastic hinge formed about the frame x axis - probable rivet failure.	No apparent frame x axis plastic hinge formed in cargo floor post - no rivet failure.
No plastic hinge formation of cargo floor post about the frame y axis.	Cargo floor post plastic hinge formed about frame y axis - rupture of posts at attachment to frame.

Predicted Results	Observed Results
Plastic hinge formed in lower frame at center line of frame model.	Plastic hinge formed in lower frame at center line of frame model.
No plastic hinge allowed in the passenger cabin floor beam.	Plastic hinge appears to form in the passenger cabin floor beam near the frame center line (mass point 8 in figure 3-13).
Maximum c.g. deflection occurs at 0.045 second after impact.	Maximum crushing of structure in cargo floor region occurs approximately 0.05-0.06 second after impact.

After review of the photos and video tape, the frame model was modified as follows:

- Cargo floor post beam connecting mass 2 to mass 14. Massless nodes were introduced to simulate the offset of neutral axes at the attachment of the cargo floor post to the frame and to the cargo floor beam.

  The frame x axis plastic hinge was removed. Rupture is allowed at a moment equivalent to the frame y axis plastic hinge moment.

- Passenger cabin floor beam connecting mass 7 to mass 8. A plastic hinge is allowed at the attachment of the beam to mass 8.

The revised model is shown in figure 3-17.

Using the revised model two cases were run. Each of the runs simulated a drop velocity of 20 ft/sec. One of the runs was at a zero pitch angle while the second is at a 2 degree nose down pitch angle. With the new model, failure of the cargo floor post due to bending about the frame y axis was duplicated during the 2 degree pitch case but not during the zero pitch case. Thus this failure mode appears to be sensitive to the pitch angle of the frame at the time of impact. The large moments about the frame x axis observed in the earlier run are still prevalent in both runs using the revised model.

Results of the two runs using the revised frame model show that the maximum vertical acceleration response levels of the passenger cabin floor (masses 7 and 8) are sensitive to the degree of plastic hinge formation in the cabin floor beam. The acceleration levels for masses 7 and 8 are shown in figure 3-18 for the 2 degree pitch case. The maximum acceleration levels are 34 g's and 33 g's for masses 7 and 8, respectively. For the zero degree impact case the maximum acceleration levels are 36 g's and 33 g's, respectively.

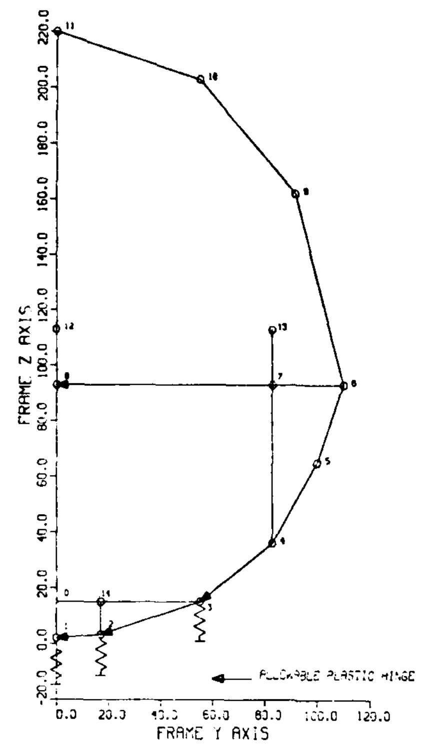


FIGURE 3-17. DC-10 FRAME MODEL (REVISED)

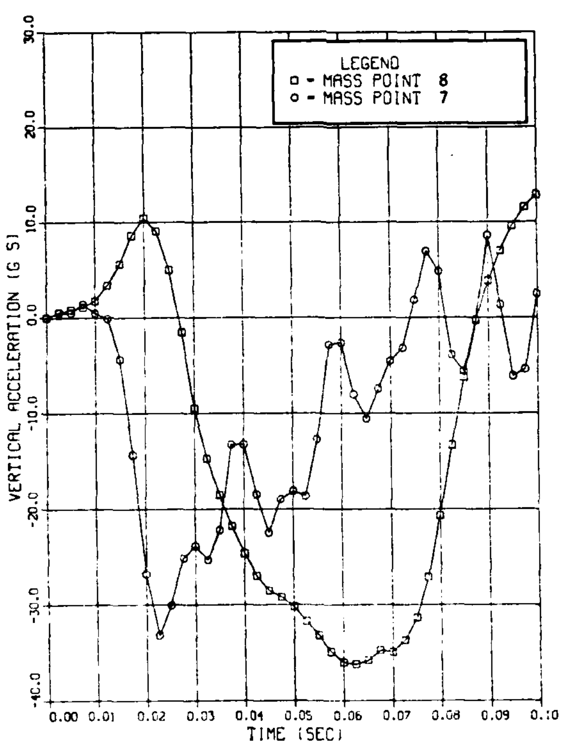


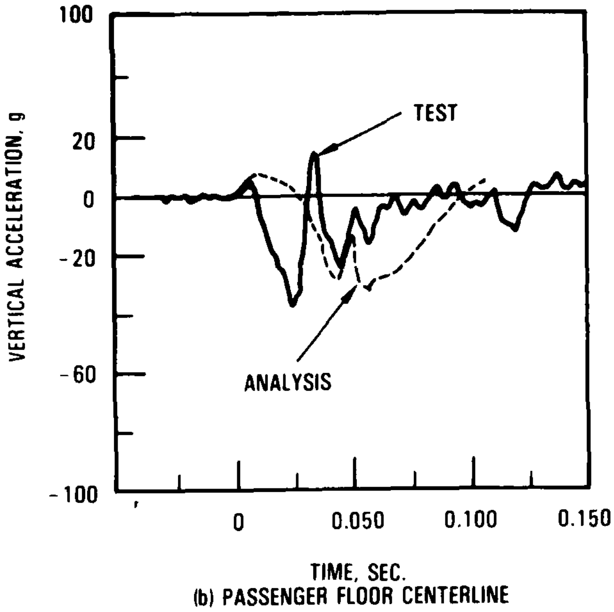
FIGURE 3-18. PASSENGER CABIN FLOOR ACCELERATION TIME HISTORY (REVISED MODEL)

The c.g. loads and displacements predicted during the zero pitch and 2 degree pitch cases using the revised model were not significantly different than those obtained using the original frame model. The maximum c.g. loads and deflections are 39,000 pounds, 6.2 inches and 38,000 pounds, 6.4 inches for the zero pitch and 2 degree pitch cases, respectively.

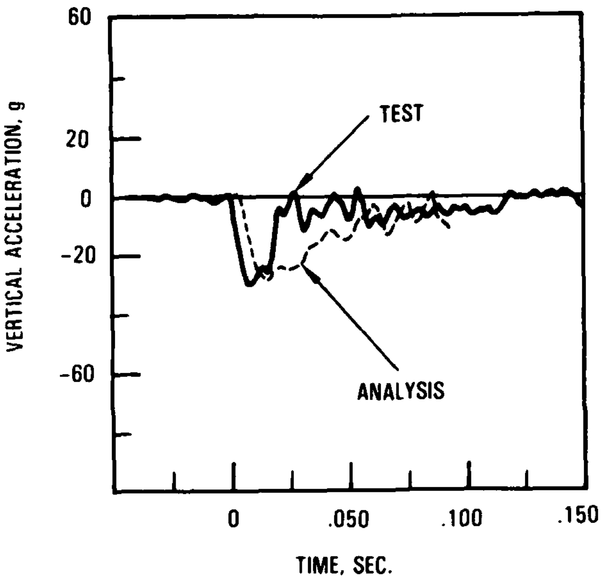
Subsequent to revising the frame model, test acceleration response data were reported in reference 13. Figure 3-19 shows a comparison between the analysis and test results at two passenger cabin floor locations. In both instances the peak levels are in good agreement. However, the time of occurrence of the peak response or the duration differs between the test and analysis results. The assumption of a plastic hinge at the floor centerline for the analytical model could tend to result in a more plastic (longer duration) response than is observed in the test data.

The discussion to this point has been confined to frame segment tests and analyses. Frame sections are considered soft compared to stiff bulkheads, and as such the passenger cabin floor responses tend to be muted. The DC-10 section responses are high in magnitude compared to the B707 frame sections due to 1) low test mass loading and 2) the type of construction (i.e., floor posts which provide an alternate load path). Hard points, such as those located at major bulkheads, are more likely to transmit high magnitude, short duration pulses to the passenger cabin floor. A test of a B707 fuselage center section is reported in reference 14. The post-test results including floor time history responses are shown in figure 3-20. The test specimen which weighed approximately 8000 lbs., including anthropomorphic dummies, exhibited little deformation and floor vertical peak responses between 60g to 90g, with a pulse base duration of around 20 milliseconds. A section more fully loaded and with wing mass might exhibit more crushing and lower broader response levels.

The occupant vertical responses for a location in proximity to the floor responses (figure 3-20) is shown in figure 3-21. From the curves in figure 3-21 it can be observed that the pelvic peak vertical response is around 36g to 44g for a nearly triangular pulse with a base duration of 40 milliseconds. Thus the dummy response is lower and broader than that exhibited at

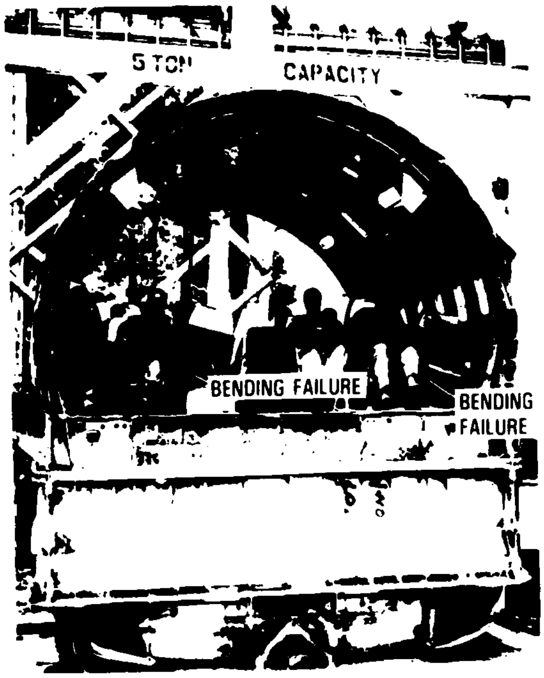


(b) PASSENGER FLOOR CENTERLINE

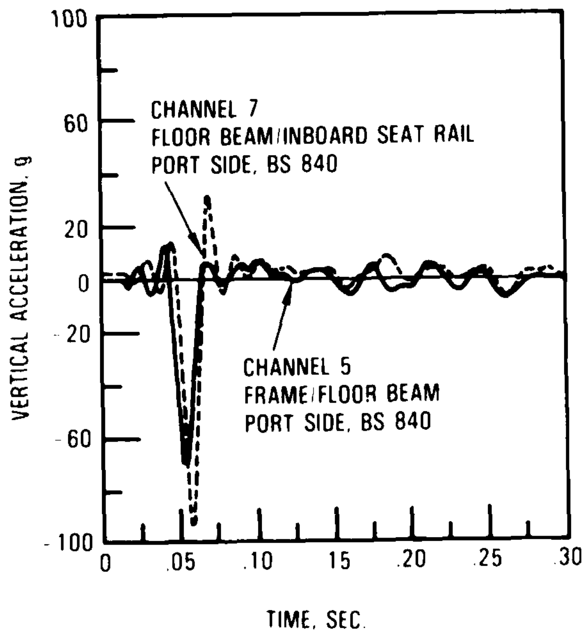


(a) PASSENGER FLOOR/FLOOR POST INTERSECTION

FIGURE 3-19. COMPARISON OF WIDEBODY FRAME SECTION ANALYSIS AND TESTS RESULTS



POST TEST VIEW



TIME HISTORY VERTICAL RESPONSE AT PASSENGER FLOOR

FIGURE 3-20. RESULTS OF NARROW-BODY AIRPLANE FUESLAGE CENTER SECTION TEST

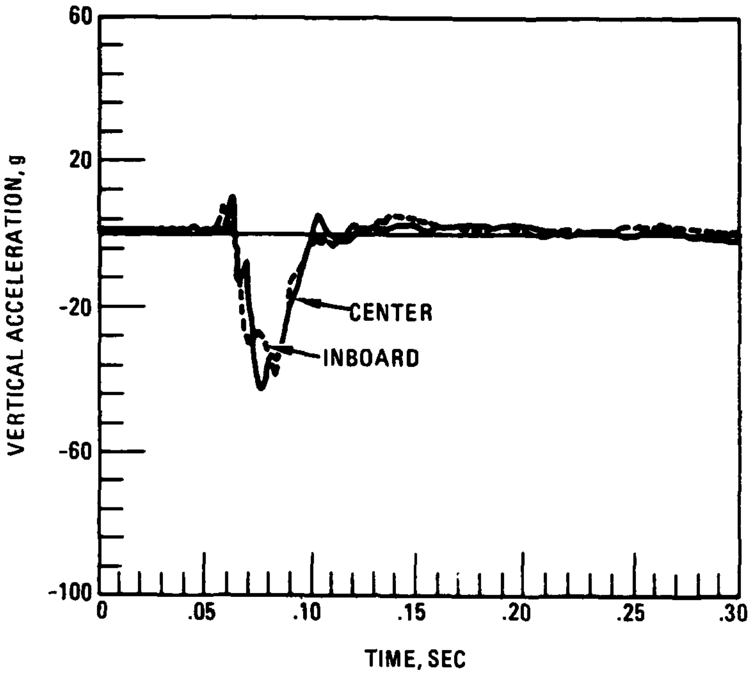


FIGURE 3-21. ACCELERATION TIME HISTORIES MEASURED IN ANTHROPOMORPHIC DUMMIES LOCATED IN FUSELAGE CENTER SECTION

the floor. By contrast a corresponding dummy response for the B707 drop test is closer to 8g peak, 100 millisecond base duration and between triangular and trapezoidal in shape (figure 3-4). To what degree the occupant could be exposed to a serious injury due to vertical loading depends on how injury criteria are specified and measured. For combined loading (vertical-longitudinal or longitudinal-lateral) the criteria can get more difficult to define.

SECTION 4

PRELIMINARY KRASH ANALYSIS

4.1 GEARS-RETRACTED ANALYSIS

The flow diagram, shown in figure 4-1, outlines the procedure being followed to assess the effect of sink speed on airframe structural integrity using the available structural data and state-of-the-art analysis. A KRASH stick model was established to facilitate providing inputs into the Controlled Impact Demonstration (CID) test plan with regard to a desirable test impact condition. The stick model is shown in figure 4-2. The model consists of 27 masses and 26 beam elements. For the analysis a symmetrical half-airplane model consisting of 19 masses and 18 beam elements is used. The beam stiffness and mass properties are derived from manufacturer provided data. The model accounts for lower fuselage crushing and major bulkhead loads through the use of external (ground contact) springs along the fuselage. The frame crushing characteristics are developed from separate KRASH model analyses of narrow-body fuselage section tests, as described in Section 3. Bulkhead load-deflection characteristics are obtained from results of a narrow-body bulkhead segment test and previous wide-body airplane analyses (reference 7). The fuselage mass point locations and designations are identified in table 4-1. The difference between the KRASH model fuselage station and airplane body station designations is due to three extra frames in the forebody between station 600 and 620 and two less frames in the aftbody between station 960 and 1020. The fuselage frame and bulkhead load-deflection curves used with the stick model are shown in figures 4-3 and 4-4, respectively. The load range investigated is between the solid and dashed lines. The objective of this initial effort is to obtain overall fuselage shears, moments and accelerations. Preliminary estimates of fuselage shear and moment capability were obtained from manufacturer provided data. The data are in the form of moment versus shear at several locations. A typical moment-shear interaction curve was shown earlier in figure 2-3. For each interaction curve the stringers, whose locations are shown in figure 2-4, can be identified.

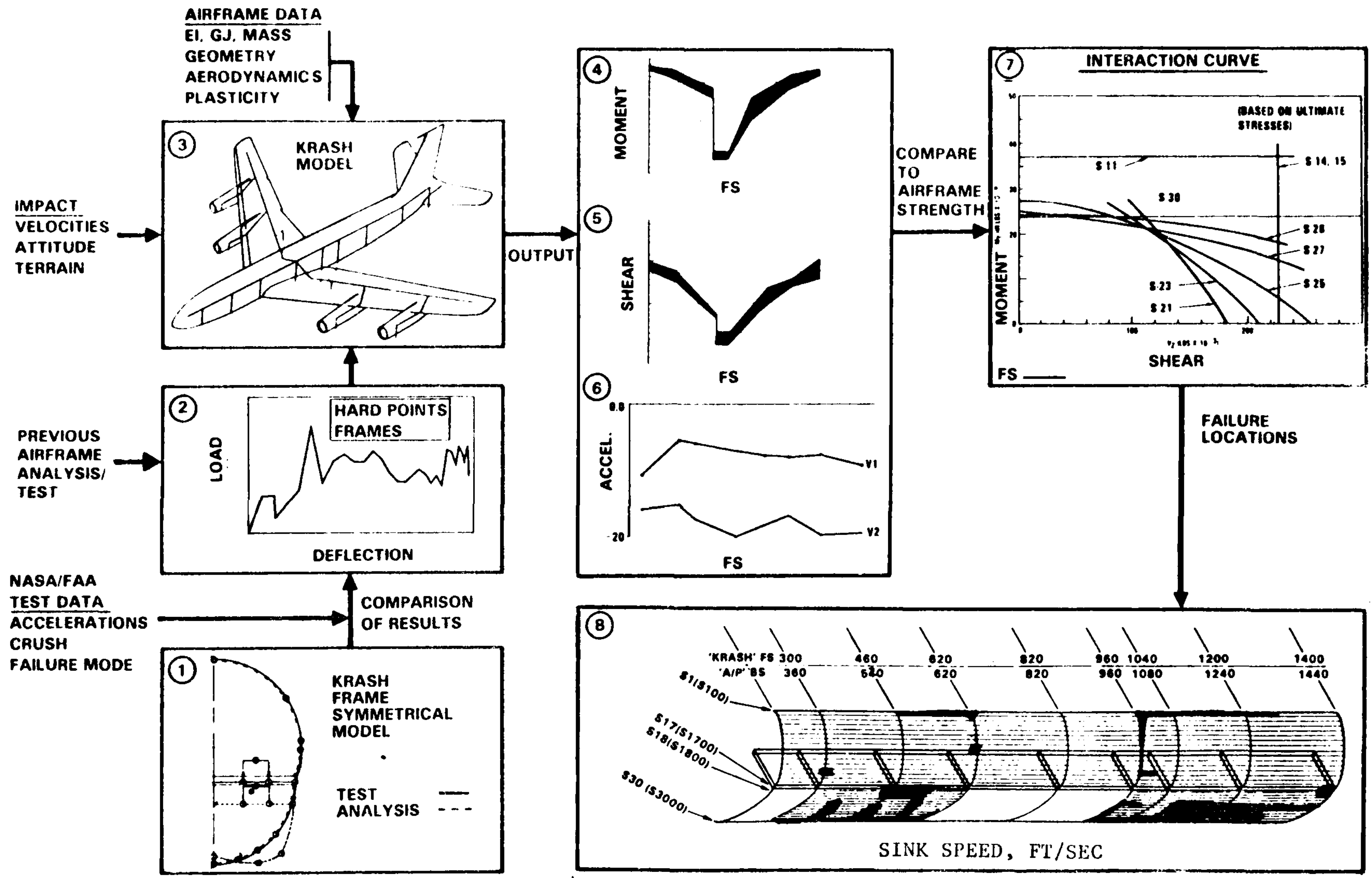


FIGURE 4-1. OUTLINE OF ANALYTICAL APPROACH

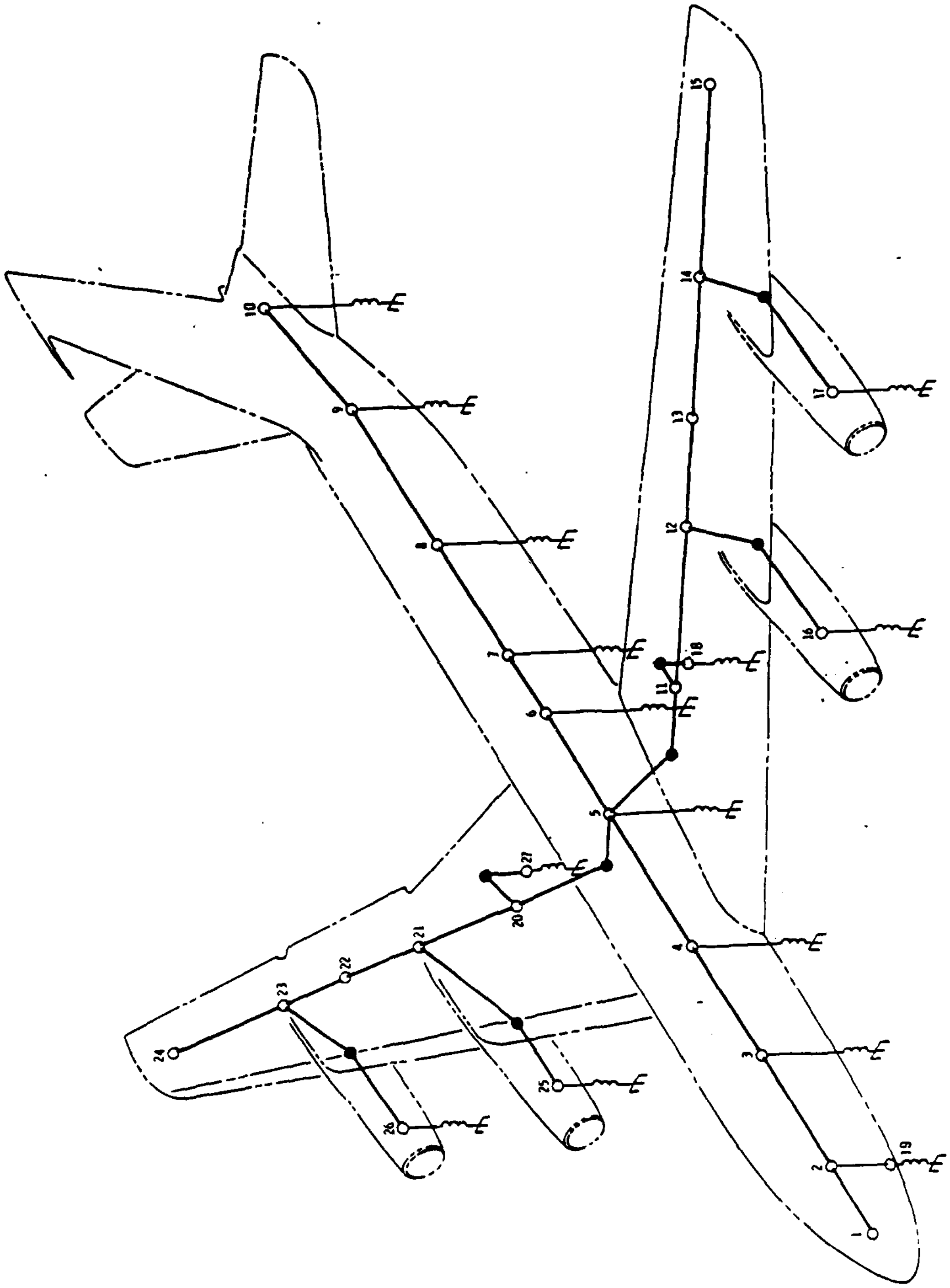
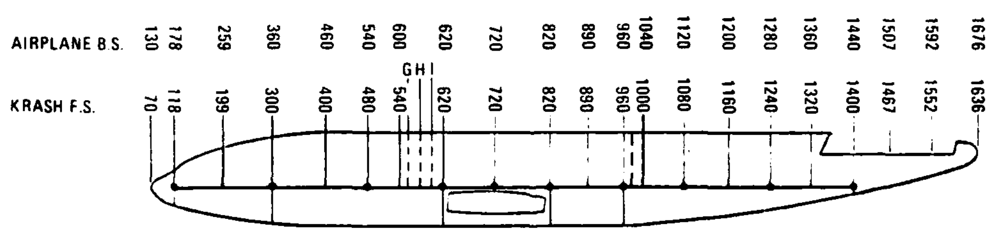
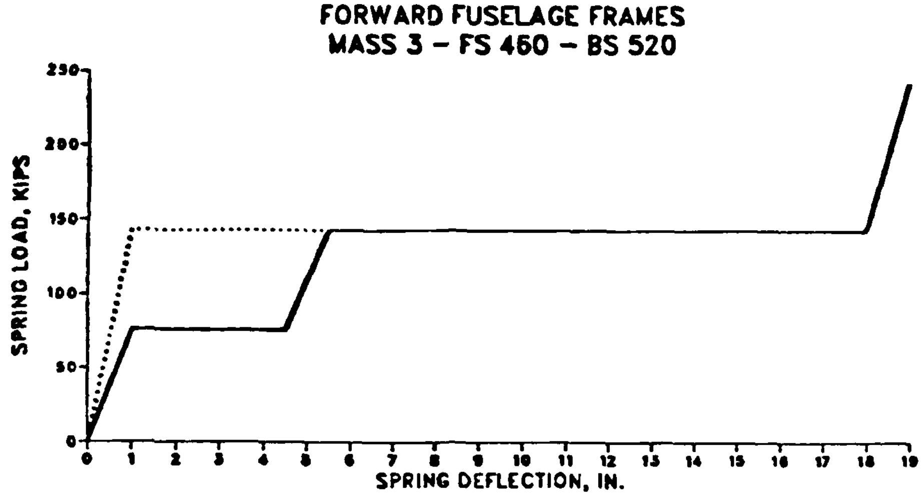


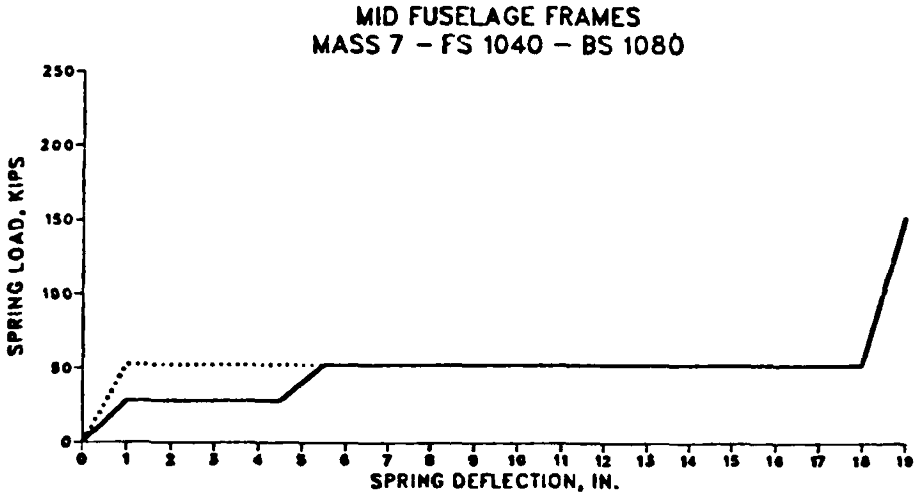
FIGURE 4-2. CID KRASH STICK MODEL

TABLE 4-1. KRASH MODEL FUSELAGE MASS POINT LOCATIONS

MASS NO.	KRASH FUSELAGE STATION	AIRPLANE BODY STATION	LOCATION REPRESENTATION
1	199	259	Nose Gear Wheel Well, forward bulkhead
2	300	360	Nose Gear Wheel Well, rear bulkhead
3	460	520	Forward fuselage frames
4	620	620	Wing center section, forward
5	820	820	Wing center section, rear
6	960	960	Main landing gear rear bulkhead
7	1040	1080	Mid fuselage frames
8	1200	1240	Mid-aft fuselage frames
9	1400	1440	Aft pressure bulkhead
10	1570	1610	Empennage







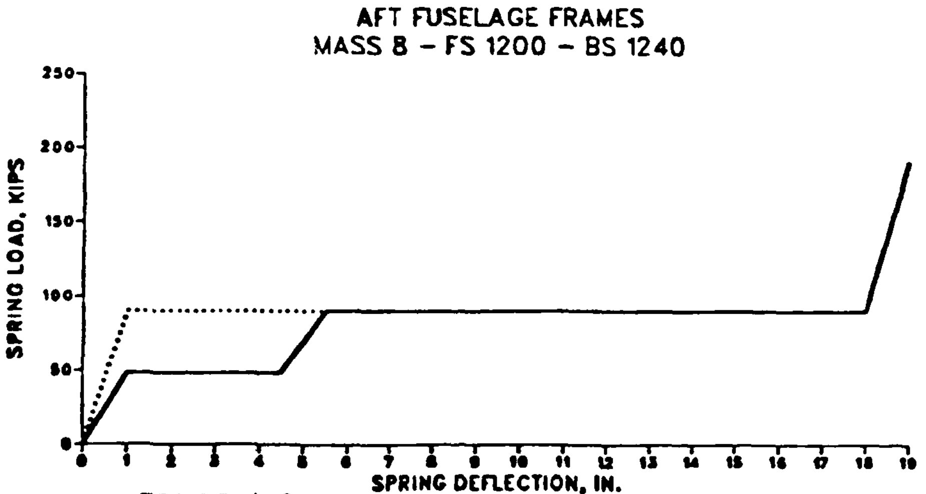


FIGURE 4-3. CID MODEL FRAME CRUSH SPRINGS

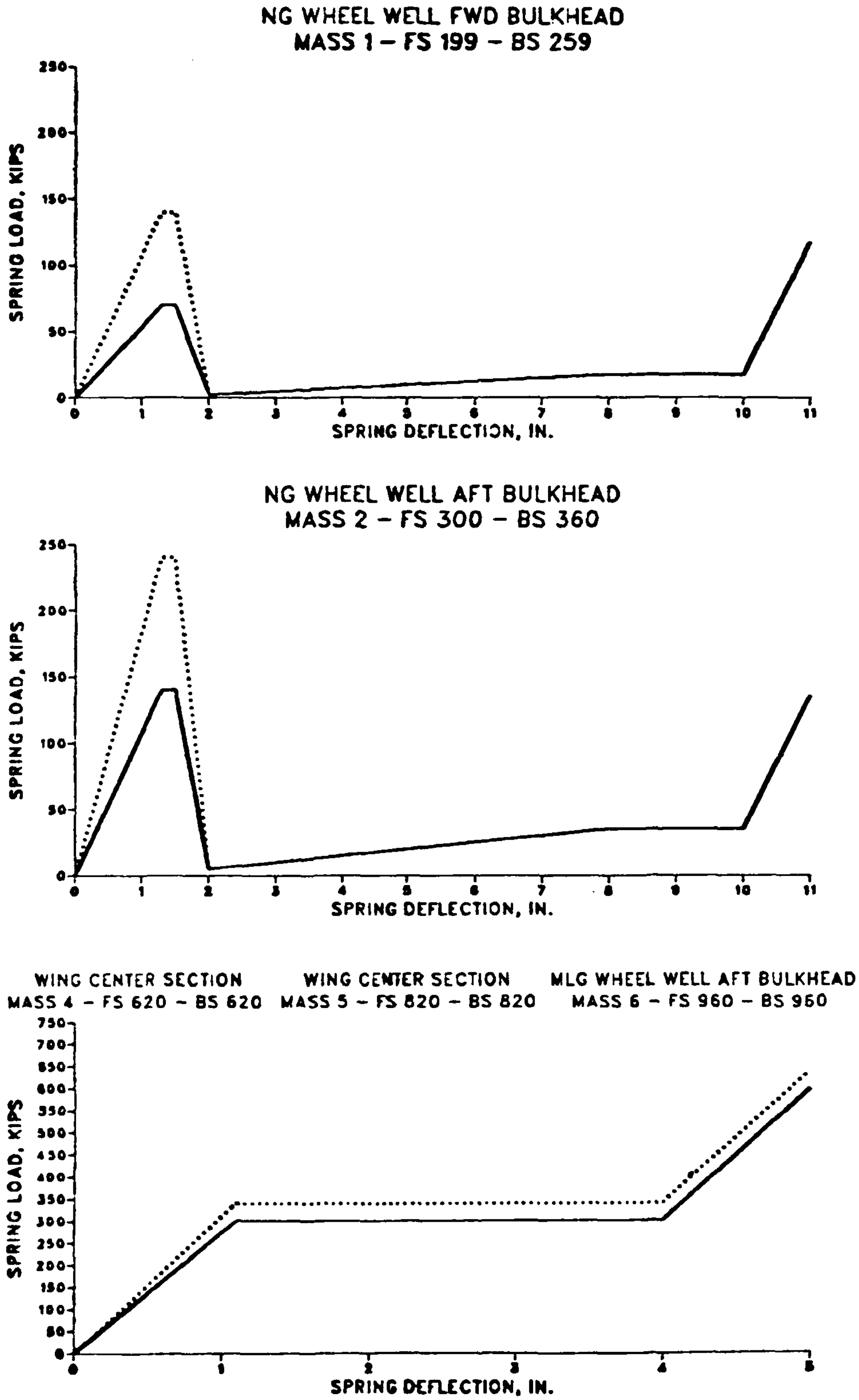


FIGURE 4-4. CID MODEL HARD POINT SPRINGS

The lower stringers are subject to failure due to compression and crushing loads. The middle stringers (S9 through S20) are vulnerable to high shear loads. The upper stringers would most likely fail under high bending tensile loads. The results of the load-interaction analysis are used in a qualitative sense to determine the relative sensitivity of regions of the airframe with gears-up to a range of impact velocities from 8 to 17 ft/sec, for a 155 knot forward velocity and one-degree nose-up attitude condition. The revised IC subroutine, in which KRASH-NASTRAN combined usage provides a static balance for an assumed 1g aerodynamic loading distribution, was used. As part of this initial study a sensitivity analysis was performed to ascertain how the results are affected by changes in the input data parameters. The solid and dotted lines in figures 4-3 and 4-4 indicate the range in load variation investigated. Figures 4-5 and 4-6 present results in the form of normalized LIC ratios for changes in fuselage underside load-deflection characteristics as noted in figures 4-3 and 4-4, as well as changes with regard to fuselage stiffness or plasticity and initial aerodynamic loading. Lower loads are experienced for a softer fuselage, increased plasticity and for a no lift condition, as can be observed in figures 4-5 and 4-6.

Figure 4-7 shows results in the form of normalized LIC ratio as a function of changes in hard point load-deflection characteristics as noted in figure 4-8. The variations noted in figure 4-8 differ from those previously described in figure 4-4 in that the spring bottoming characteristics are affected. The response of the airframe is very sensitive to the hard point inputs, more so than to the soft frames. For the case analyzed, the aft fuselage loads increase substantially as a result of "bottoming" on hard points.

A qualitative assessment of the gear-up condition is shown in figure 4-9. The structure damage obtained from the stick model analysis is shown for a range of impact velocity conditions from 10 ft/sec to 17 ft/sec. The darkened regions in figure 4-9 indicate areas where potentially severe damage could occur. It is difficult to determine the degree of damage (i.e., separation) using the model and data described. An interpretation given to these results indicates a potential for aft fuselage separation to occur at a 17 ft/sec impact velocity. The stick model approach provides an overview of trends and an

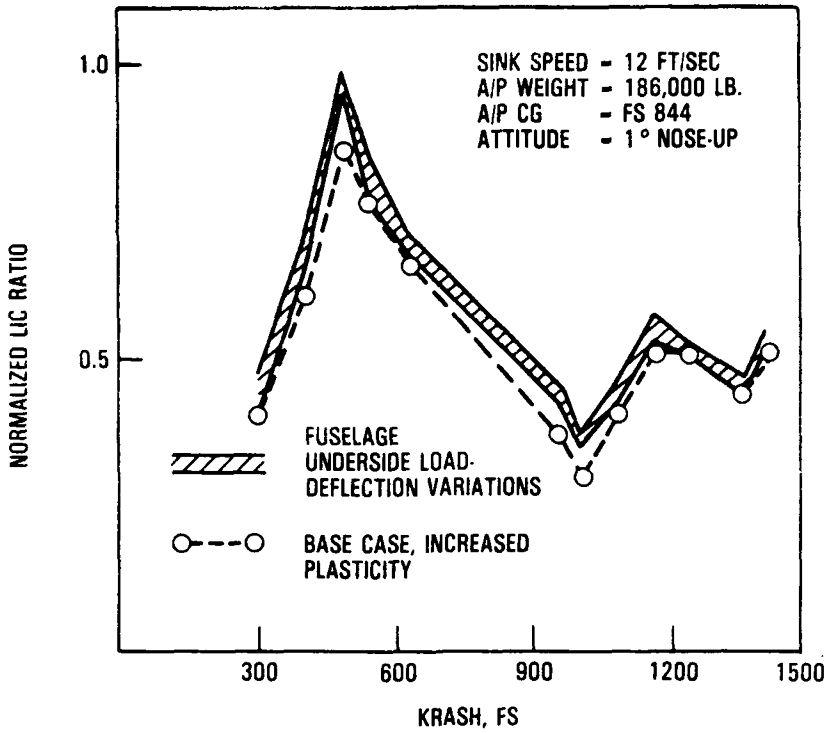


FIGURE 4-5. COMBINED LOAD RATIOS, FOR FUSELAGE UNDERSIDE LOAD-DEFLECTION VARIATIONS

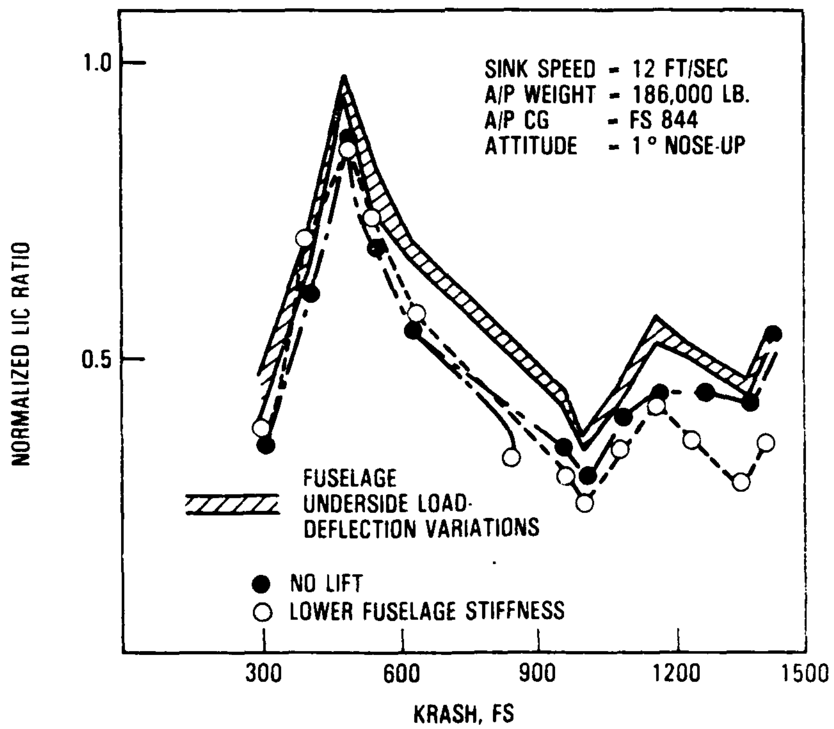


FIGURE 4-6. COMBINED LOAD RATIOS, COMPARISONS FOR 'NO LIFT' AND REDUCED FUSELAGE STIFFNESS

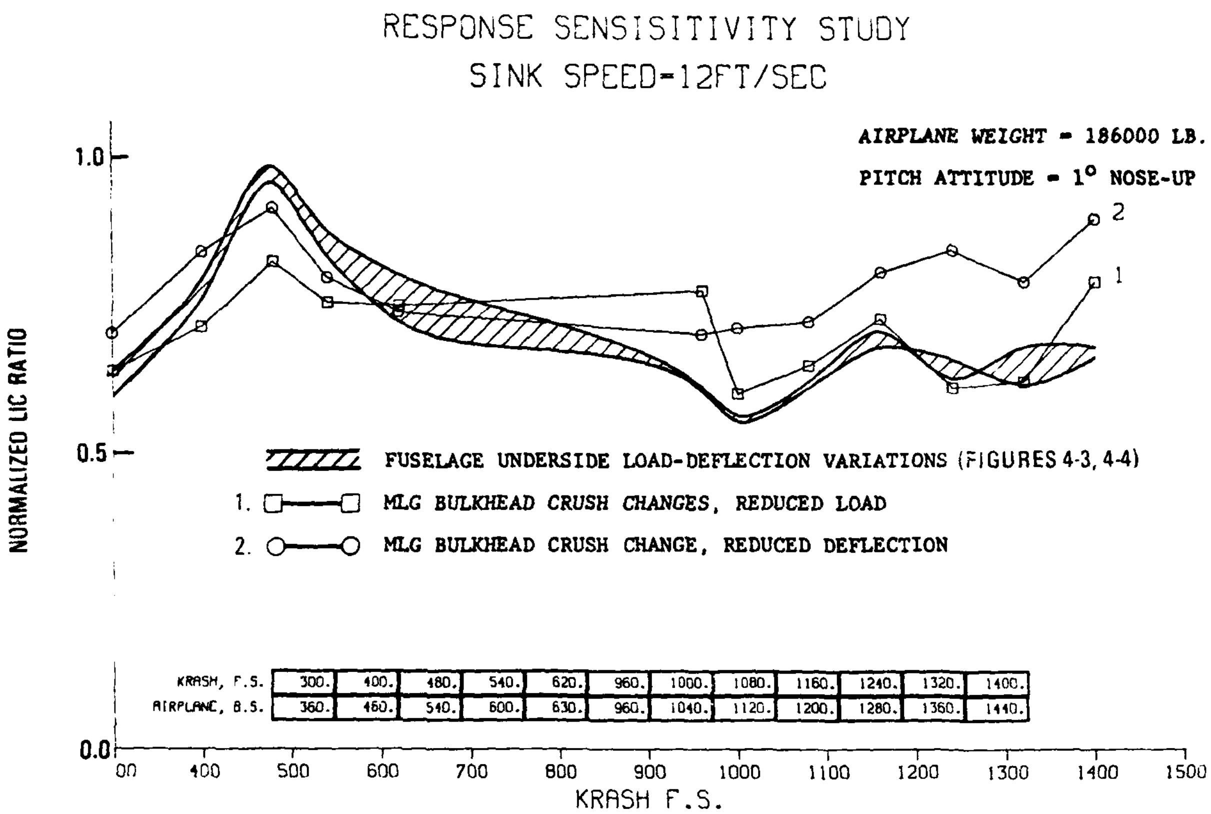


FIGURE 4-7. COMBINED SHEAR-MOMENT LOADS AS A FUNCTION OF MLG BULKHEAD LOAD-DEFLECTION REPRESENTATION

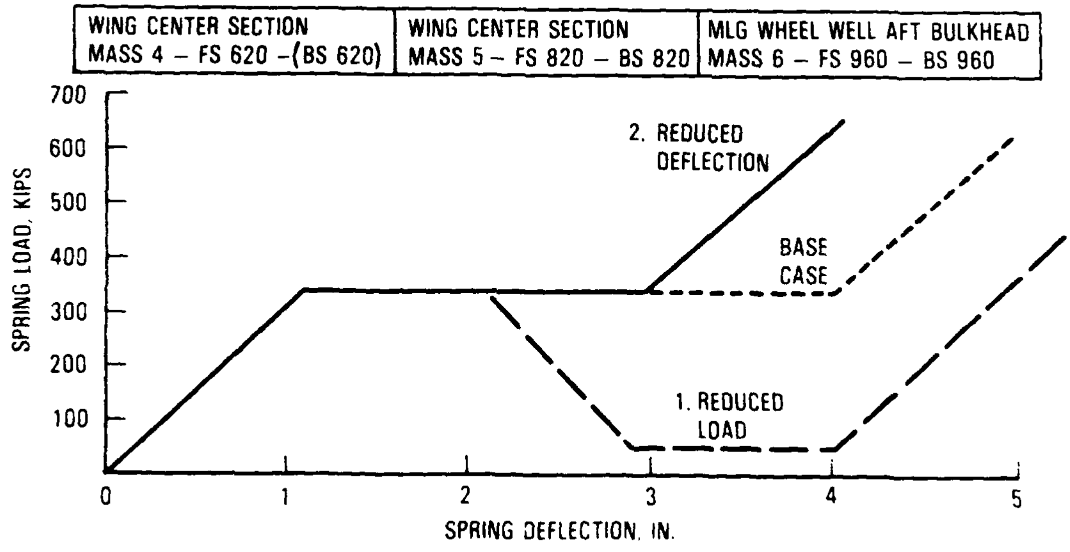


FIGURE 4-8. MODEL HARD POINT LOAD-DEFLECTION VARIATIONS

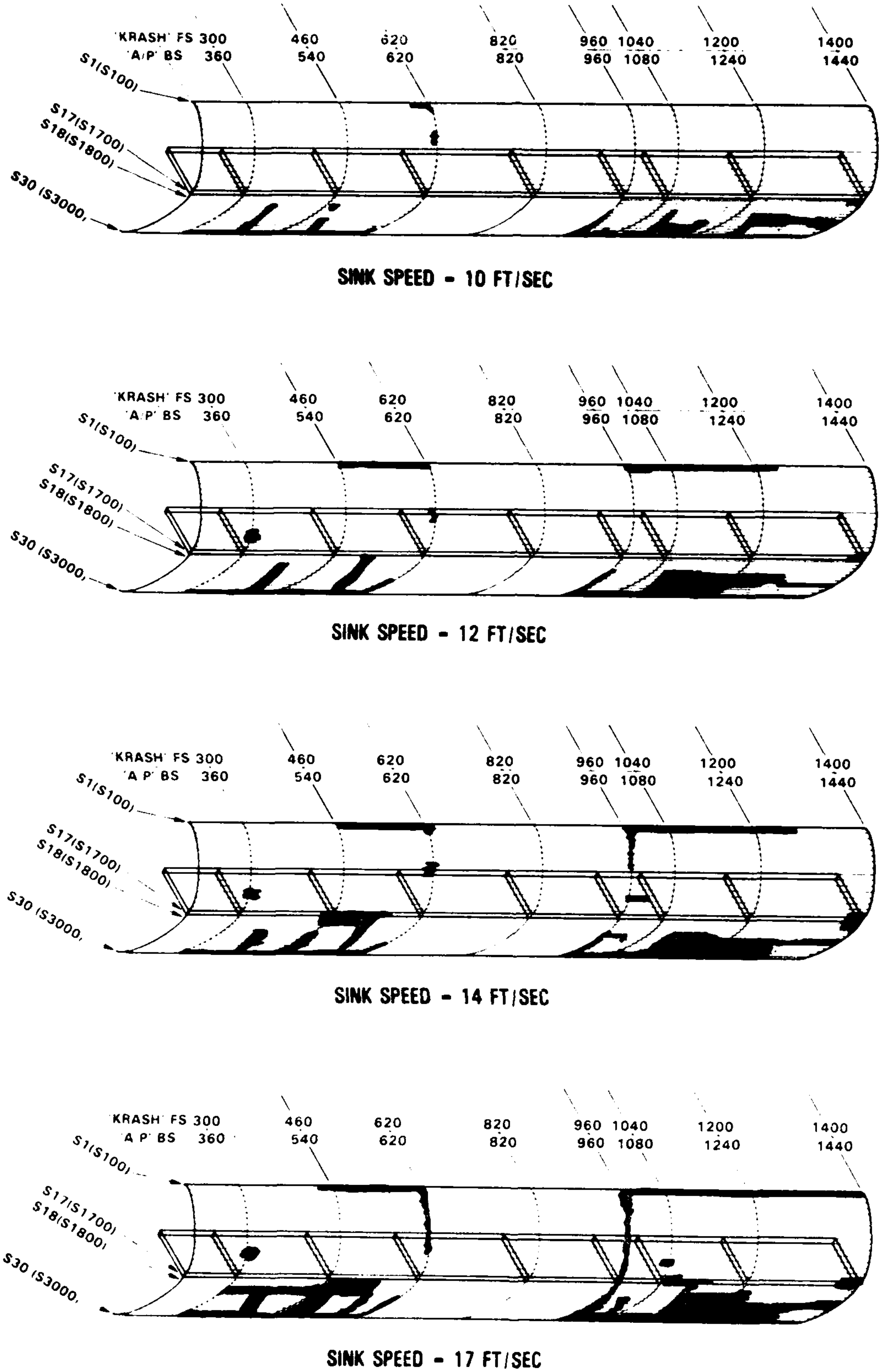


FIGURE 4-9. FUSELAGE DAMAGE AS FUNCTION OF SINK SPEED, KRASH ANALYSIS, 1° NOSE-UP IMPACT

insight into potentially critical regions. However, the approach has limitations with regard to 1) incorporating the effects of local plasticity, 2) the sensitivity to representation of fuselage underside structure, particularly hard points, and 3) the accuracy of available airframe structural capability data.

4.2 COMPARISONS WITH GEARS-EXTENDED AND SLOPE IMPACTS

Comparisons were also made between the gear-up and gear-extended configurations. The procedure for performing gear-extended analysis was as follows:

1. The manufacturer-provided main gear load-stroke drop test data at 12 ft/sec was matched, using the KRASH oleo metering pin coding. The comparison is shown in figure 4-10. The tests were conducted at a landing weight, with an equivalent single gear weight of 48100 pounds.

2. Based on the matching of the test data with a simulated oleo metering pin, the damping (C_D) versus stroke characteristic of the metering pin is derived (see figure 4-11).

3. Using the metering pin characteristics, shown in figure 4-11, high sink speed conditions are then run with the KRASH stick model including landing gears.

The results of the gear-extended analysis, following the approach outlined above, are compared to the gear-up analysis results in table 4-2. From table 4-2, it can be observed that a full gear stroke is anticipated up to a 20 ft/sec vertical sink speed impact. However, at 20 ft/sec impact sink speed, while the gear may not fail, the combined load ratio (>1.0) could result in fuselage failure at the MLG bulkhead (BS 960). Based on the stick model analysis, the gear-extended condition in the impact velocity range of 18 to 20 ft/sec appears to be comparable to a gears-up impact velocity of 8 to 12 ft/sec. The analysis results indicate that the fuselage average overall accelerations are lower for the gears-extended than for the gears-up condition. To ascertain the validity of the above-noted comparison, a single gear model was run for impact sink speeds of 10, 20 and 30 ft/sec. The results of these analyses are shown in figure 4-12. A takeoff weight is used for these results, with an equivalent single gear weight of 92,335 pounds. These simple model results illustrate that up to an impact velocity of 20 ft/sec, one might expect to obtain a large percentage of the stroking capability of the gear. At a 30 ft/sec sink rate the stroke, based on a MLG load capability of 350 to

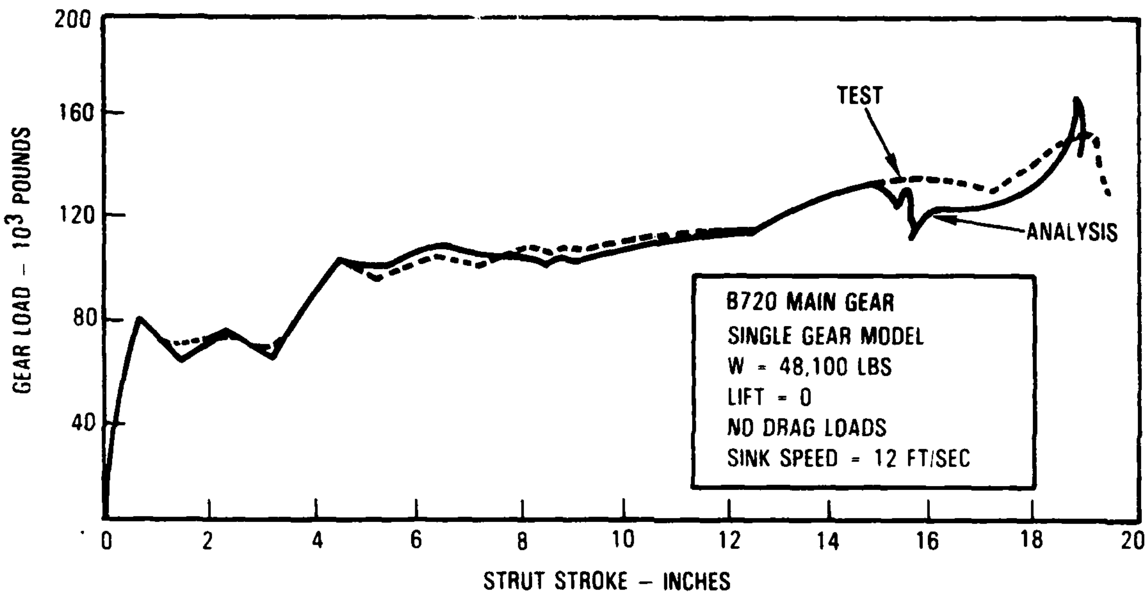


FIGURE 4-10. DUPLICATION OF KNOWN TEST LOAD-DEFLECTION CURVE USING METERING PIN CODING IN KRASH85

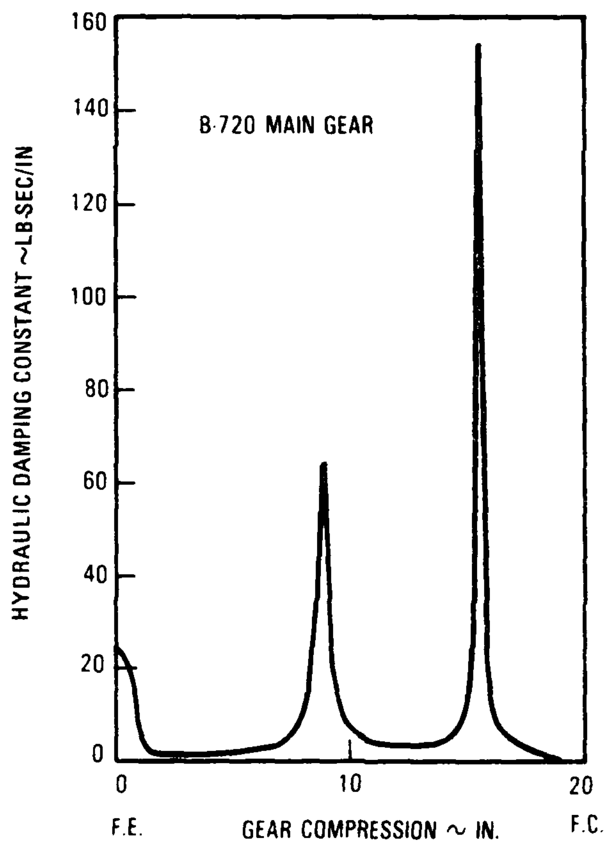


FIGURE 4-11. OLEO METERING PIN DAMPING CONSTANT VERSUS GEAR COMPRESSION

TABLE 4-2. GEAR-UP VERSUS GEAR EXTENDED ANALYSIS RESULTS

CONFIGURATION	IMPACT SINK SPEED FT/SEC	AVERAGE VERTICAL ACCELERATION "G's"	COMBINED MOMENT-SHEAR LOAD RATIO	
			BS 620	BS 960
Gears-Retracted	8	8.1	.89	.93
	10	9.9 ***	1.3 ***	1.05 ***
	12	12.8 ***	1.4 ***	1.08 ***
	14	14.3 ***	1.4 ***	1.21 ***
	17	18.7 ***	1.4 ***	1.88 ***
Gears-Down	18*	6.6	.48	.84
	20**	7.8	.72	1.13

$+1^{0}$ Nose-Up Attitude, 186,000 Lb. Airplane

* 18.8 Inch Stroke, No Gear Failure

** 19.0 Inch Stroke, No Gear Failure

***These values are high. Subsequent airplane drop test data (*see Section 5*) *indicates that hardpoint* springs at FS 620, 820 960 do not 'bottom out' at the deflections used in this analysis.

430 KIPS, might reduce to ≈35 percent of its maximum stroke. Based on airplane taxi design considerations, one could anticipate a MLG for the CID airplane to be capable of 360 to 420 KIPS vertical load. Current widebody airplane Main Landing Gears are designed for a vertical load in excess of 600 KIPS/Gear.

Since previous transport airplane crash tests were of the ground-to-ground variety the question of "how the planned CID air-to-ground impact compares with a ground-to-ground (ramp) impact?" is of interest. Figure 4-13 illustrates the ramp initial impact conditions (representative of ground-to-ground) that are comparable to air-to-ground initial impact conditions with regard to initial velocities and contact points. Using KRASH, a comparison of results was made for a ramp impact such as the L1649 test (reference 15) versus the planned air-to-ground impact. For both impacts, it was assumed that the forward velocity and sink speed, respectively, were equal. The two impact conditions are depicted as conditions IIA and V, in figure 4-13. The results, shown in figure 4-14, indicate that the combined shear-moment load as depicted by the LIC ratio normalized to the peak value is lower for the ground-to-ground impact, except at the forward end. The LIC ratios for the air-to-ground

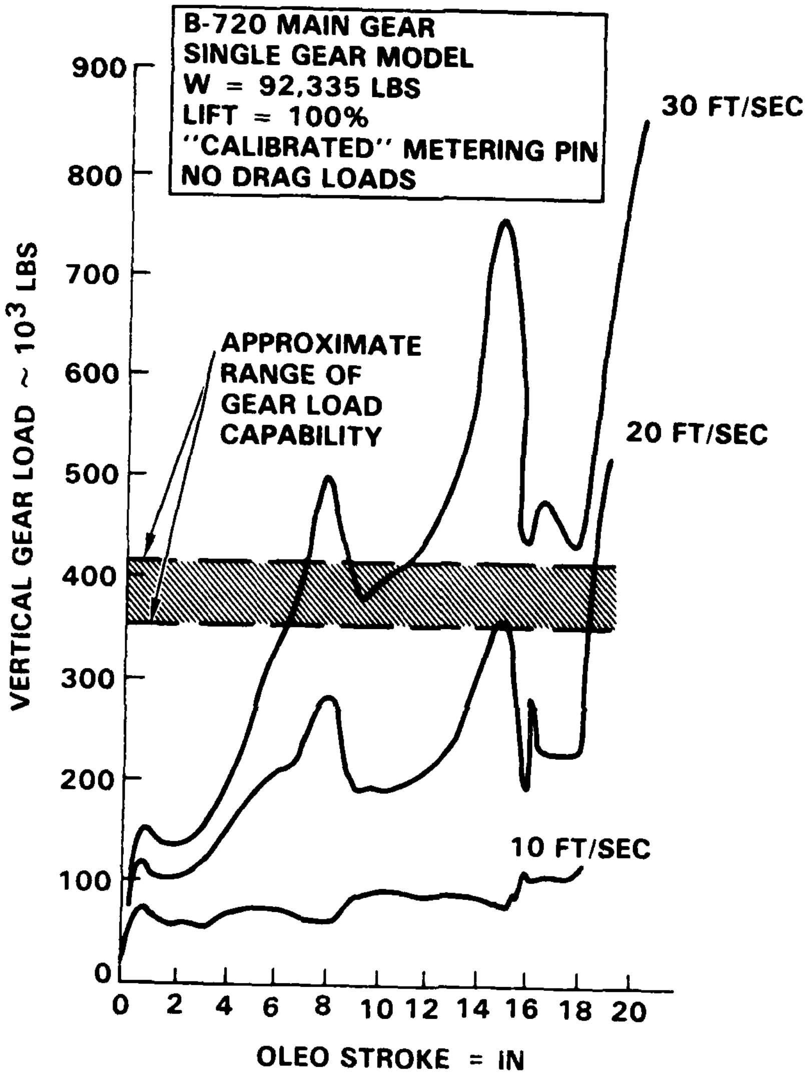


FIGURE 4-12. SINGLE GEAR MODEL ANALYSIS RESULTS

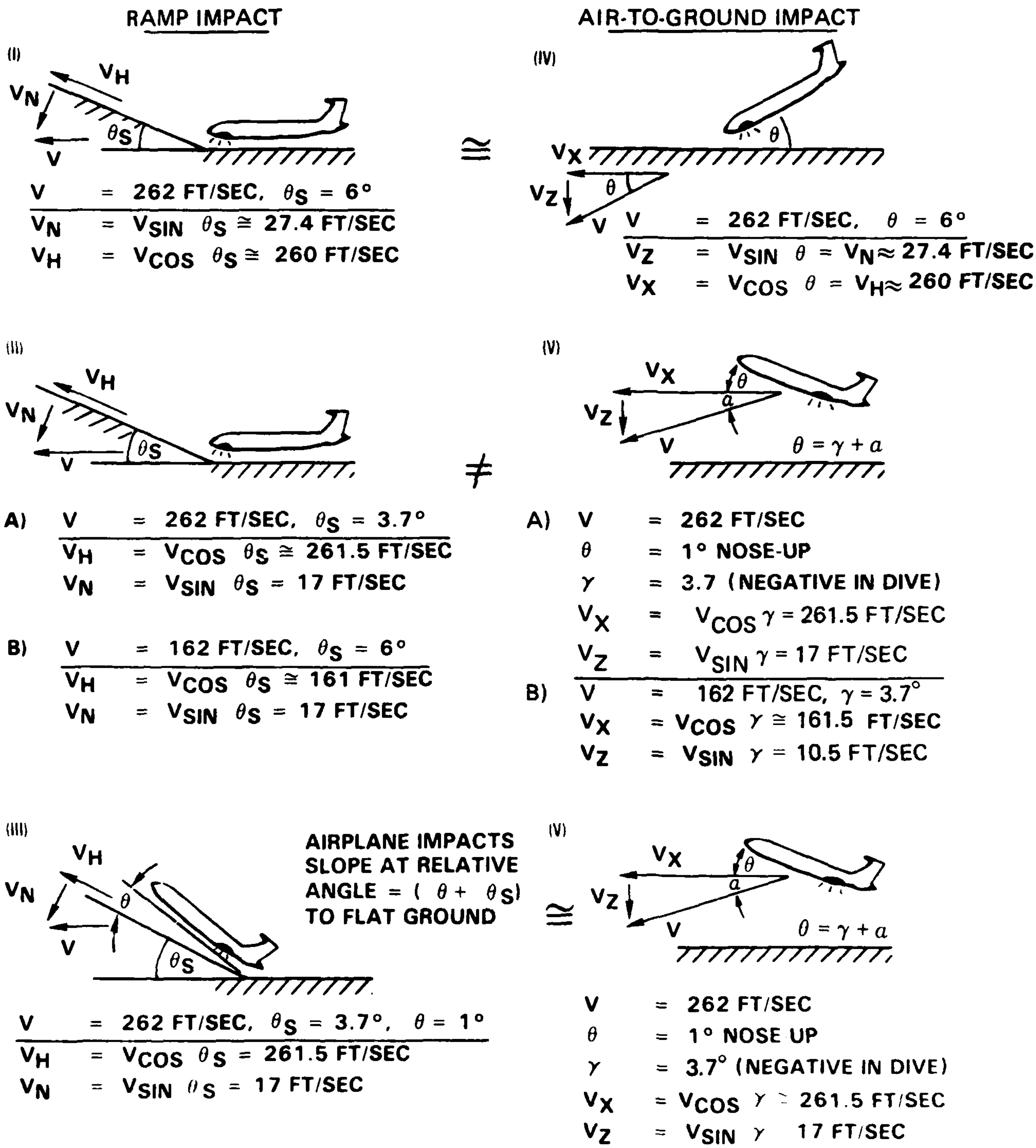
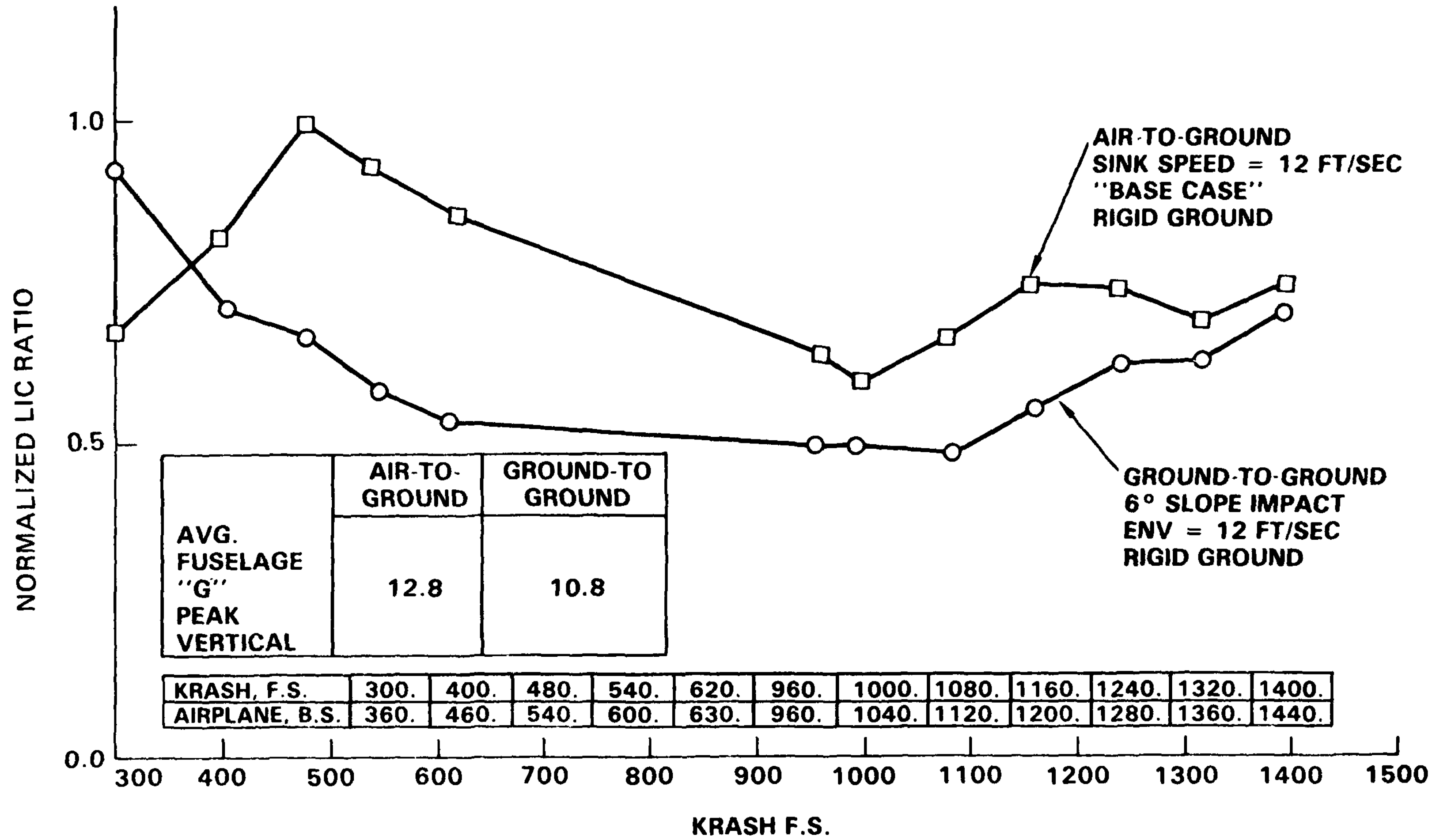


FIGURE 4-13. INITIAL IMPACT CONDITIONS; RAMP VERSUS AIR-TO-GROUND IMPACT



	AIR-TO-GROUND	GROUND-TO GROUND
AVG. FUSELAGE "G" PEAK VERTICAL	12.8	10.8

KRASH, F.S.	300.	400.	480.	540.	620.	960.	1000.	1080.	1160.	1240.	1320.	1400.
AIRPLANE, B.S.	360.	460.	540.	600.	630.	960.	1040.	1120.	1200.	1280.	1360.	1440.

FIGURE 4-14. KRASH RESULTS, AIR-TO-GROUND VERSUS GROUND-TO-GROUND IMPACTS

condition are high in the aftbody due to 'slapdown' as the airplane rotates onto the aft section after initial impact. Since both analyses are for a rigid ground one would anticipate longitudinal accelerations to be low and comparable for both conditions. As can be observed from figure 4-13 a ramp impact similar to that shown in condition III would be a closer approximation of the planned air-to-ground impact (condition V).

4.3 SEAT/OCCUPANT RESPONSE TO A LONGITUDINAL PULSE

Seat-occupant analyses were performed with the KRASH model developed under a previous transport airplane crash dynamics study (reference 6). A review of the KRASH stick model results shows that the responses, at any particular location, can possibly be described in several ways. For example, for the gears-up impact condition (V_x = 155 kts, V_v = 17 ft/sec, 1° nose-up) figure 4-15 shows that the longitudinal pulse shape at FS 960, can be described as:

A. Triangular, 5.9g peak acceleration, 0.010 second base

B. Sawtooth, increasing to the 5.9g peak acceleration, 0.07 second duration

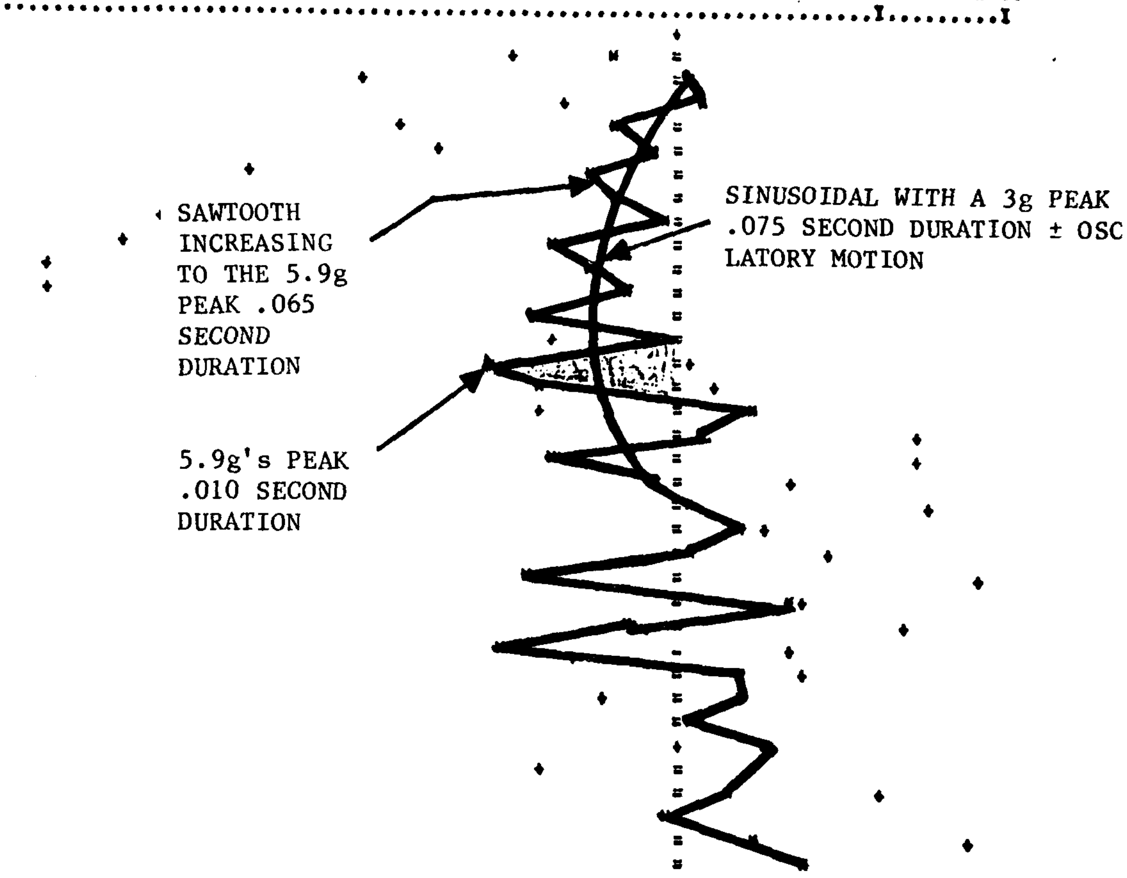
C. ≈sinusoidal, with a 3g peak acceleration, 0.065 second duration.

For each of these pulses the occupant would respond differently. Figure 4-16 shows the results of an analysis using the KRASH occupant-seat model developed and correlated with CAMI-seat longitudinal pulse test data (reference 6). The data provided in figure 4-16 demonstrate that for the half sine and sawtooth pulses, the occupant could experience 4.9g to 5.3g accelerations at the pelvis. For the 0.01 second triangular pulse the same response would be barely over 1g. For lap belt only restraints, the occupant rotations are shown to be 4.5^o, 27.2^o and 25^o, for cases A, B, and C, respectively.

The analytically determined pulses at FS 620 (wing leading edge) and FS 820 (wing trailing edge) are shown in figures 4-17 and 4-18). They can be characterized as trapezoidal with a peak acceleration of 3.2g to 3.3g and a base duration of 0.050 to 0.055 seconds. The corresponding pelvic responses from the KRASH seat model, shown as case G in figure 4-19, indicate a 5.8g acceleration response and occupant rotation of 29.5 degrees. Cases D, E, F, in figure 4-18, illustrate response as a functions of other pulses. Case D

TIME(SEC)	XACCF *	YACCF *	ZACCF +
0.0	0.0	0.0	0.0
0.005	-2.055E 00	0.0	-5.205E 00
0.010	3.692E-01	0.0	-9.817E 00
0.015	8.163E-01	0.0	-3.454E 00
0.020	-2.043E 00	0.0	-8.774E 00
0.025	-8.462E-01	0.0	-7.640E 00
0.030	-2.906E 00	0.0	-1.345E 01
0.035	-1.889E 00	0.0	-1.278E 01
0.040	-5.736E-01	0.0	-1.612E 01
0.045	-3.895E 00	0.0	-1.757E 01
0.050	-2.945E 00	0.0	-1.973E 01
0.055	-1.559E 00	0.0	-1.901E 01
0.060	-4.705E 00	0.0	-1.251E 01
0.065	-1.348E-02	0.0	-4.167E 00
0.070	-5.857E 00	0.0	2.505E-01
0.075	-4.554E 00	0.0	1.133E 00
0.080	2.433E 00	0.0	-4.283E 00
0.085	7.034E-01	0.0	7.393E 00
0.090	-3.943E 00	0.0	7.632E 00
0.095	-1.004E 00	0.0	3.726E 00
0.100	5.145E-01	0.0	7.962E 00
0.105	1.856E 00	0.0	2.927E 00
0.110	5.530E-01	0.0	4.626E 00
0.115	-4.071E 00	0.0	9.470E 00
0.120	3.456E 00	0.0	3.957E 00
0.125	-1.696E 00	0.0	6.934E 00
0.130	-5.671E 00	0.0	3.444E 00
0.135	1.934E 00	0.0	4.086E 00
0.140	2.105E 00	0.0	-2.505E 00
0.145	4.206E-01	0.0	7.330E-01
0.150	2.591E 00	0.0	1.364E-01
0.155	-4.464E 00	0.0	-4.573E 00
0.160	1.405E 00	0.0	6.451E 00
0.165	-4.910E-01	0.0	-1.134E 01
0.170	2.411E 00	0.0	8.930E 00
0.175	3.749E 00	0.0	-2.383E 01

SCALE FACTOR = 3.965E 00



XACCF = Longitudinal Accel.
YACCF = Lateral Accel.
ZACCF = Vertical Accel.

FIGURE 4-15. KRASH CID MODEL ACCELERATIONS AT FS960 (MASS 6)

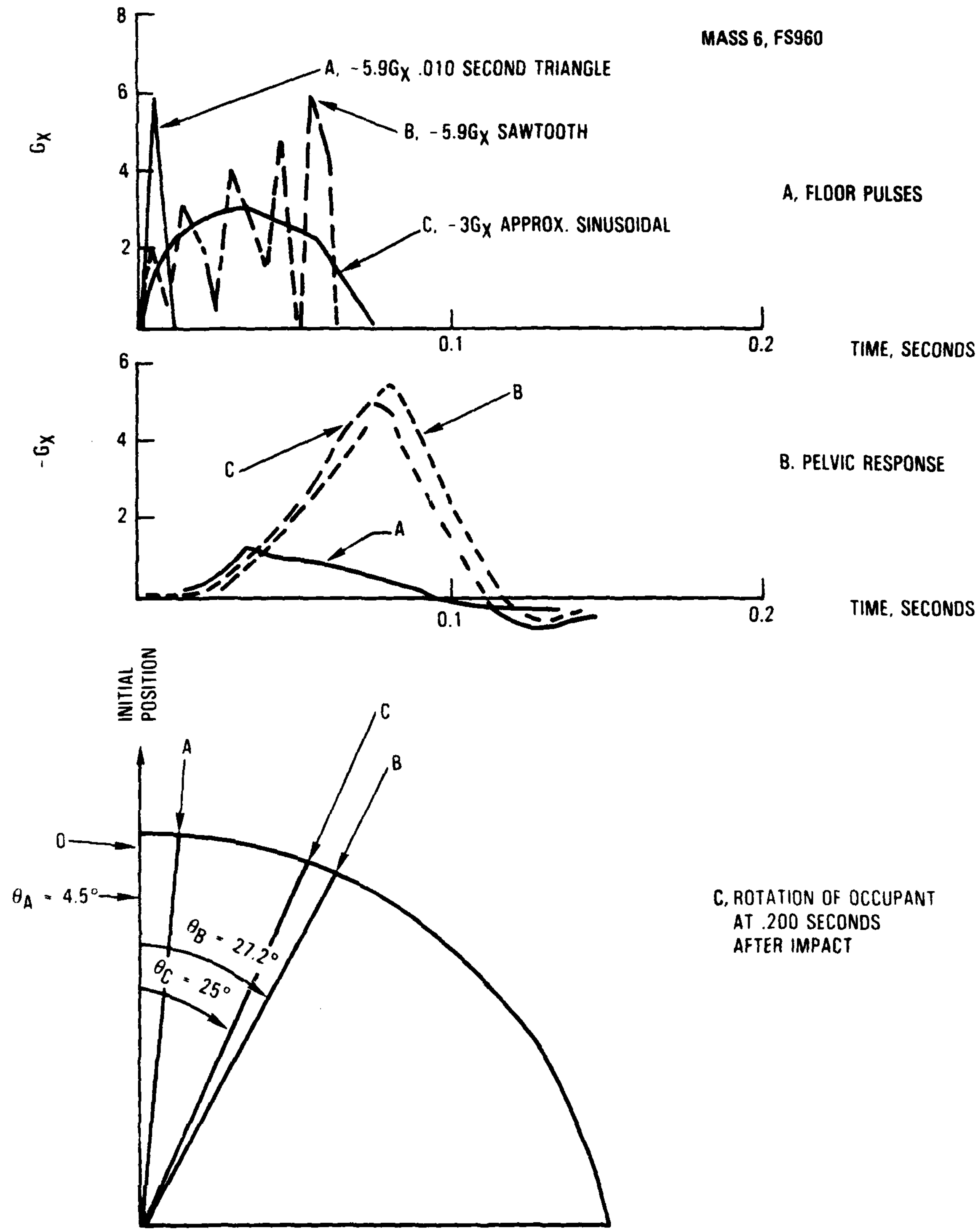
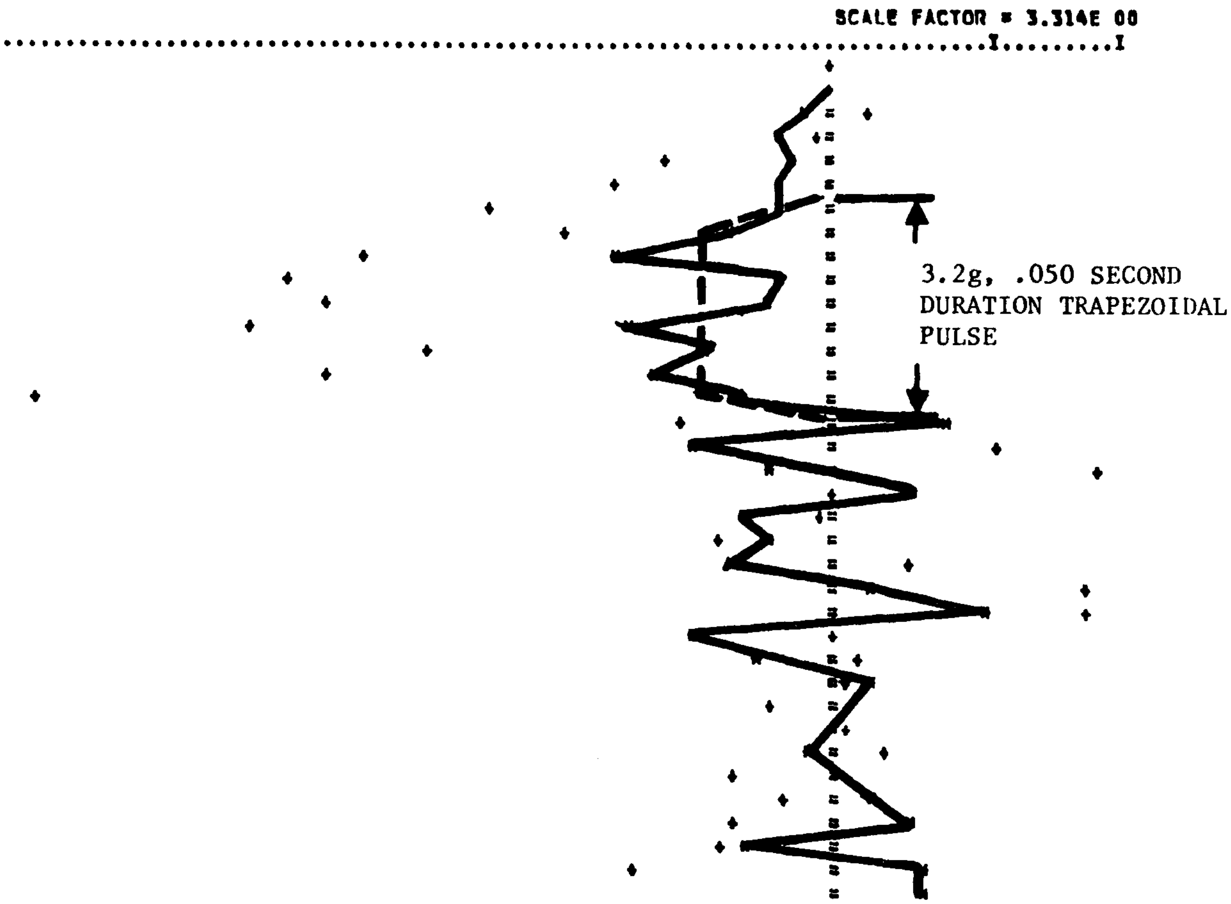


FIGURE 4-16. EFFECT OF DIFFERENCE FLOOR LONGITUDINAL PULSE REPRESENTATIONS ON OCCUPANT RESPONSE

MASS 4 FILTERED ACCELERATION(G'S), FS620, 50 HZ. FILTER

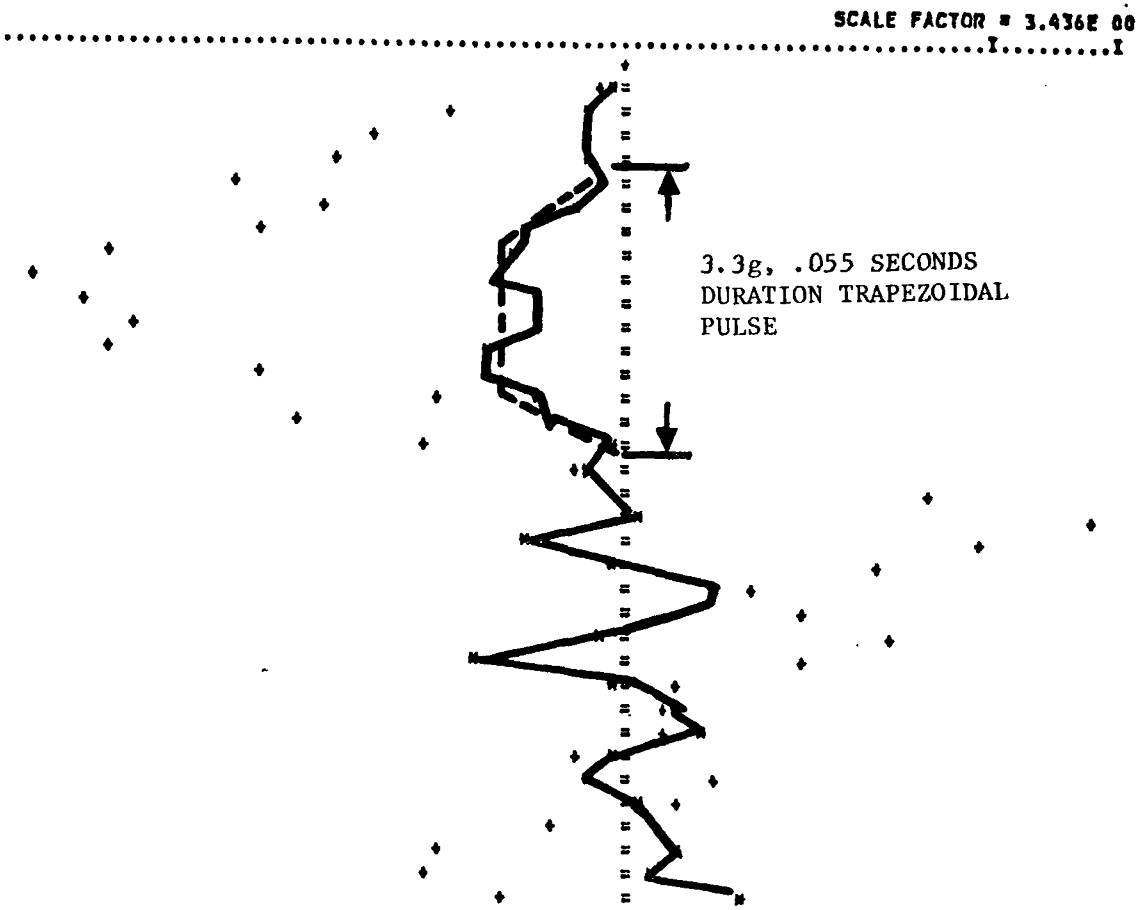
TIME(SEC)	XACCF *	YACCF =	ZACCF +
0.0	0.0	0.0	0.0
0.005	-1.389E-02	0.0	3.106E-02
0.010	-5.100E-01	0.0	1.244E 00
0.015	-1.149E 00	0.0	-1.802E-01
0.020	-8.449E-01	0.0	-4.081E 00
0.025	-1.099E 00	0.0	-5.553E 00
0.030	-1.361E 00	0.0	-8.023E 00
0.035	-2.530E 00	0.0	-6.786E 00
0.040	-5.374E 00	0.0	-1.218E 01
0.045	-1.264E 00	0.0	-1.421E 01
0.050	-1.691E 00	0.0	-1.317E 01
0.055	-5.054E 00	0.0	-1.504E 01
0.060	-3.242E 00	0.0	-1.058E 01
0.065	-4.534E 00	0.0	-1.307E 01
0.070	-2.178E 00	0.0	-2.076E 01
0.075	2.986E 00	0.0	-3.879E 00
0.080	-3.479E 00	0.0	4.378E 00
0.085	-1.650E 00	0.0	7.074E 00
0.090	2.240E 00	0.0	2.610E-01
0.095	-2.087E 00	0.0	-1.046E-01
0.100	-1.683E 00	0.0	-2.949E 00
0.105	-2.587E 00	0.0	2.237E 00
0.110	1.072E 00	0.0	6.673E 00
0.115	3.990E 00	0.0	6.811E 00
0.120	-3.485E 00	0.0	-8.585E-03
0.125	-1.810E 00	0.0	7.905E-01
0.130	9.443E-01	0.0	4.870E-01
0.135	1.106E-01	0.0	-1.513E 00
0.140	4.619E-01	0.0	3.876E-01
0.145	-4.559E-01	0.0	1.530E 00
0.150	-2.424E 00	0.0	-2.621E 00
0.155	1.027E 00	0.0	-1.097E 00
0.160	2.111E 00	0.0	-2.562E 00
0.165	-2.302E 00	0.0	-2.761E 00
0.170	2.411E 00	0.0	-5.145E 00
0.175	2.362E 00	0.0	-6.515E 00



XACCF = Longitudinal Accel.
YACCF = Lateral Accel.
ZACCF = Vertical Accel.

FIGURE 4-17. KRASH CID MODEL ACCELERATIONS AT FS620 (MASS 4)

TIME(SEC)	XACCF *	YACCF =	ZACCF +
0.0	0.0	0.0	0.0
0.005	-2.750E-01	0.0	-5.800E-01
0.010	-1.119E 00	0.0	-4.791E 00
0.015	-1.160E 00	0.0	-6.768E 00
0.020	-1.111E 00	0.0	-7.935E 00
0.025	-6.097E-01	0.0	-1.048E 01
0.030	-1.422E 00	0.0	-8.322E 00
0.035	-2.664E 00	0.0	-9.957E 00
0.040	-3.096E 00	0.0	-1.413E 01
0.045	-3.345E 00	0.0	-1.612E 01
0.050	-2.522E 00	0.0	-1.467E 01
0.055	-2.522E 00	0.0	-1.326E 01
0.060	-3.754E 00	0.0	-1.393E 01
0.065	-3.664E 00	0.0	-9.825E 00
0.070	-2.292E 00	0.0	-5.170E 00
0.075	-2.030E 00	0.0	-8.802E 00
0.000	-3.159E-01	0.0	-5.497E 00
0.005	-9.260E-01	0.0	-1.192E 00
0.090	-1.260E-01	0.0	8.131E 00
0.095	3.016E-01	0.0	1.274E 01
0.100	-2.764E 00	0.0	9.758E 00
0.105	-3.929E-01	0.0	6.966E 00
0.110	2.599E 00	0.0	3.612E 00
0.115	2.352E-02	0.0	4.972E 00
0.120	-5.077E-01	0.0	7.264E 00
0.125	-3.933E 00	0.0	4.816E 00
0.130	-4.233E-01	0.0	1.292E 00
0.135	1.306E 00	0.0	1.198E 00
0.140	2.020E 00	0.0	1.000E 00
0.145	-3.300E-01	0.0	-1.360E 00
0.150	-8.893E-01	0.0	2.409E 00
0.155	5.274E-01	0.0	1.534E 00
0.160	-1.917E 00	0.0	-2.100E 00
0.165	1.477E 00	0.0	-5.254E 00
0.170	0.170E-01	0.0	-5.630E 00
0.175	3.078E 00	0.0	-3.570E 00



XACCF = Longtitudinal Accel.
YACCF = Lateral Accel.
ZACCF = Vertical Accel.

FIGURE 4-18. KRASH CID MODEL ACCELERATIONS AT FS820 (MASS 5)

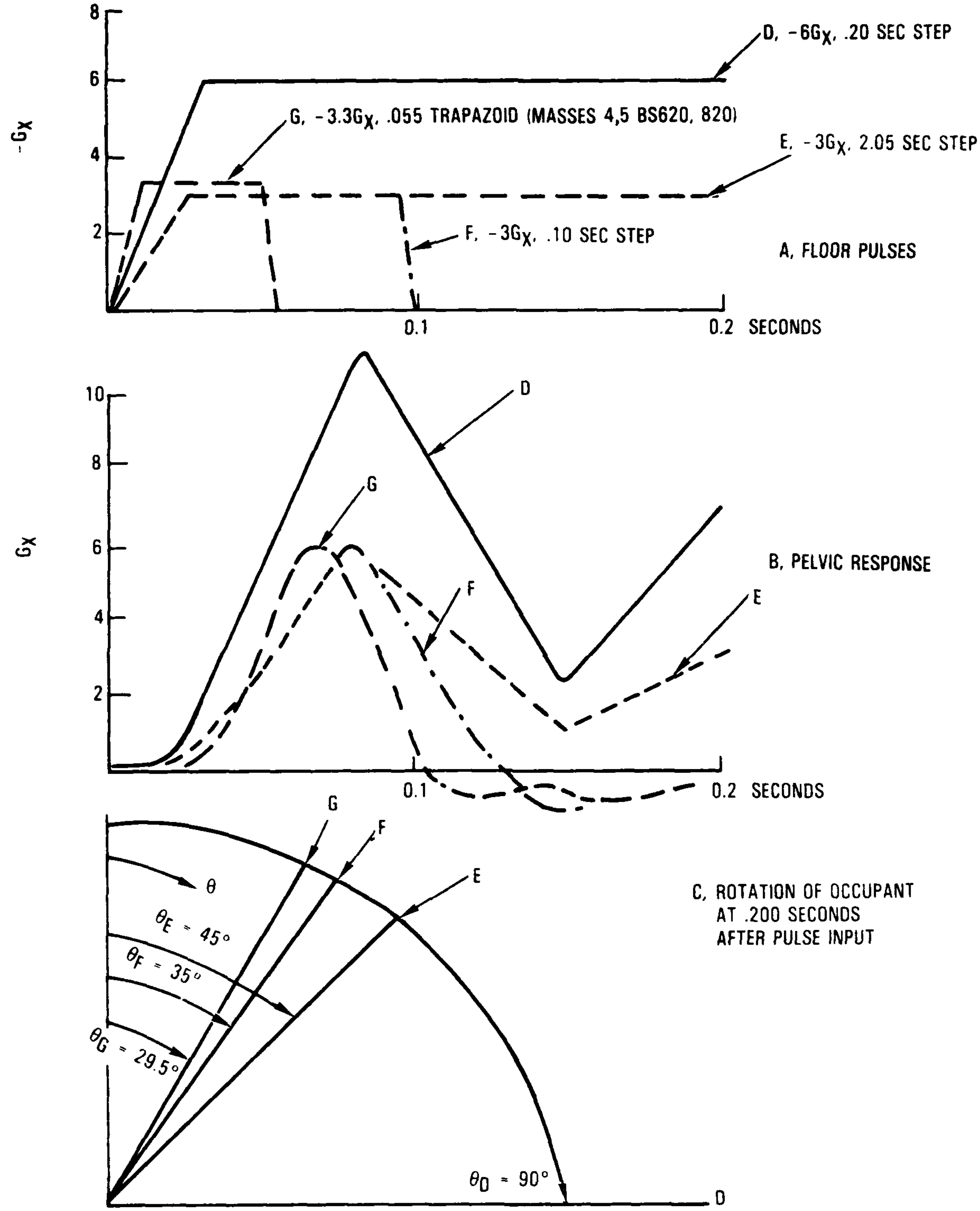


FIGURE 4-19. KRASH SEAT - OCCUPANT LONGITUDINAL PULSE ANALYSIS RESULTS

represents the condition which was tested at CAMI and with which KRASH results were compared in reference 6.

From the results shown in figures 4-16 and 4-18, it is clear that when defining pulses, it is important to consider the total pulse and not a segment of the pulse. Furthermore, the subjective interpretation of the pulse could lead to different conclusions with regard to occupant response. The KRASH obtained longitudinal pulses for the condition described could result in 5g to 6g pelvic responses for lap-belt only restrained occupant and rotations up to 30 degrees.

4.4 TEST IMPACT CONDITION SELECTION

Since the CID test involves combined Crashworthiness and Antimisting Kerosene (AMK) objectives it was recognized that the test impact conditions could be compromised. The responsible agencies selected a 17 ft/sec sink speed at impact with the airplane in a 1 degree nose-up attitude and a flight path speed of 155 knots. From the results of the preliminary analysis presented, this condition indicated the evidence of loads severe enough to challenge the structural integrity of the airframe. The extent to which damage would occur appeared to be very dependent on the hard point load-deflection characteristics and the amount of initial aft fuselage down bending provided by the aerodynamics. The CID test as described is expected to provide relatively high vertical but low longitudinal floor pulses. The previously performed L1649 test (reference 15) provided both moderate/high vertical and longitudinal impact forces. The extreme of a high longitudinal combined with a low vertical impact force is not covered in either this or the previous L1649 test. However, it is reasonable to expect that an analysis whose results have been correlated for the other combinations of loading will be satisfactory for this latter condition. Improved methodology, via KRASH, for future applications, is a major goal of this test program. With the successful acquisition of data relating input and output responses, failure modes and airframe deformation, it will be possible to achieve such a goal.

SECTION 5

NARROW-BODY AIRPLANE IMPACT DATA

5.1 AIRPLANE IMPACT TEST

A B707-131 airplane weighing 195,000 pounds and with a c.g. at FS855.14, was used in the performance of a drop test at Laurinburg, N.C. on 29 June 1984. The purpose of the test was to evaluate the airframe strength characteristics for an aircraft similar to the CID test article under comparable impact conditions (+1^{o} nose up, 17 ft/sec impact sink speed). The B707-131 airplane is 100 inches longer (20 inches forward of FS620, 80 inches aft of FS960) than the CID test article, but, basically of the same construction and design. High speed film coverage was provided. Pre- and post-test views of the test configuration are shown in figures 5-1 and 5-2, respectively. Damage to the aircraft was reviewed immediately after the impact and several weeks later, after the test vehicle had been lifted off the ground. Figures 5-3 through 5-24 show the damage that was sustained by the airplane as a result of the impact. Figures 5-3 and 5-4 show damage to the fuselage underside. It was estimated that the crush was about 2 inches, aft of the nose gear bulkhead; 4 inches, forward of the wing leading edge (FS620); and 11 to 13 inches, aft of the MLG Rear Bulkhead (FS960). The inboard wing engine pylons failed noticeably at the upper strut attach points from the pylon to the wing. Figures 5-5 and 5-6 depict the engine pylon failure. Figures 5-7 through 5-12 show damage to the vertical centerline keel and FS960 bulkhead. The bulkhead web crack is traced from the lower section up through to the floor in figures 5-9 through 5-12. Damage to the forward cargo bay at or forward of FS620 is shown in figures 5-13 and 5-14. The lower fuselage has been crushed and frame failures are noted on the centerline and along the sidewall. Figures 5-15 through 5-18 shows damage that occurred in the aft cargo bay from FS60 to FS1120. The extent of damage is

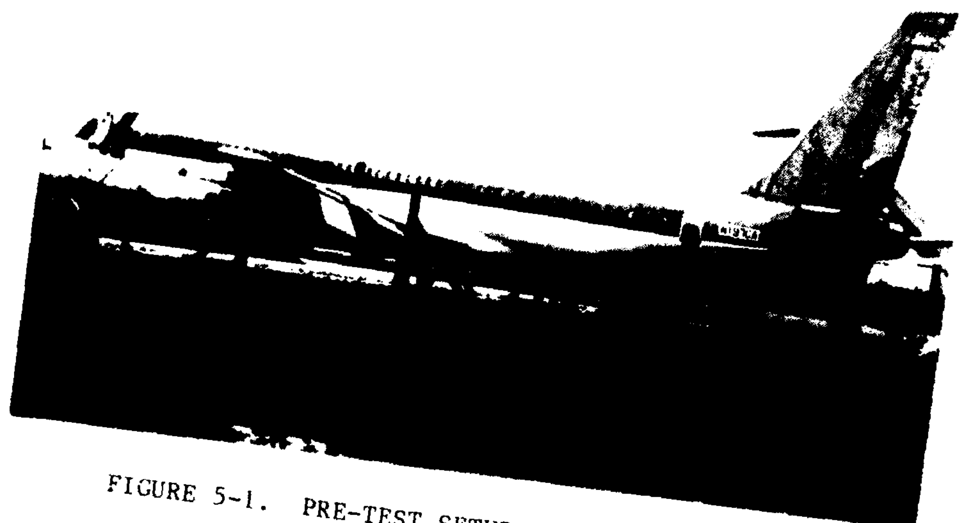


FIGURE 5-1. PRE-TEST SETUP - B707 IMPACT TEST

FIGURE 5-2. POST-TEST VIEW - B707 IMPACT TEST

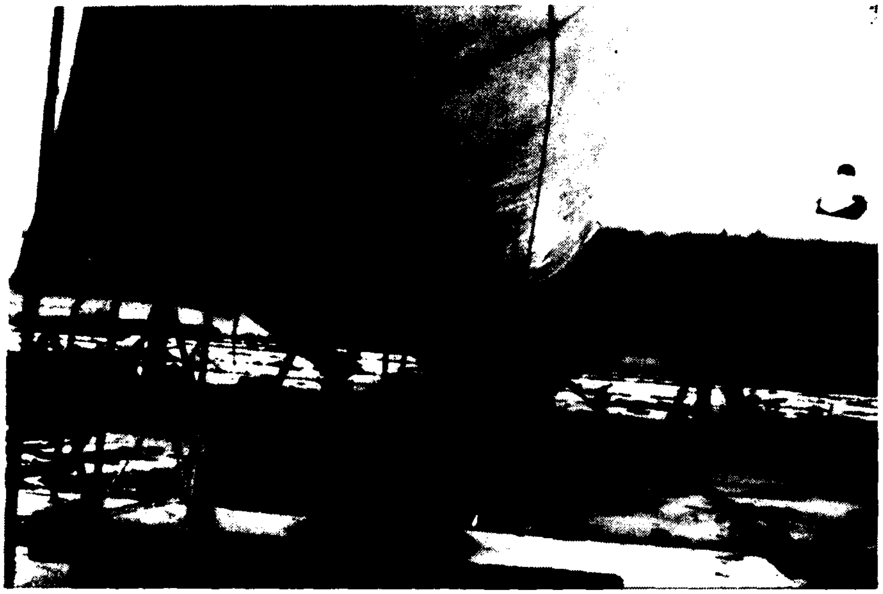


FIGURE 5-3. FORWARD LOWER FUSELAGE DAMAGE - LEFT SIDE LOOKING AFT

FIGURE 5-4. WING ROOT FAIRING - RIGHT HAND TRAILING EDGE

FIGURE 5-5. LEFT WING INBOARD PYLON FAILURE

FIGURE 5-6. LEFT HAND INBOARD PYLON - UPPER LONGERON FRACTURE

FIGURE 5-7. LEFT HAND LANDING GEAR WELL- VIEW LOOKING AFT - VERTICAL KEEL TO FS960 BULKHEAD

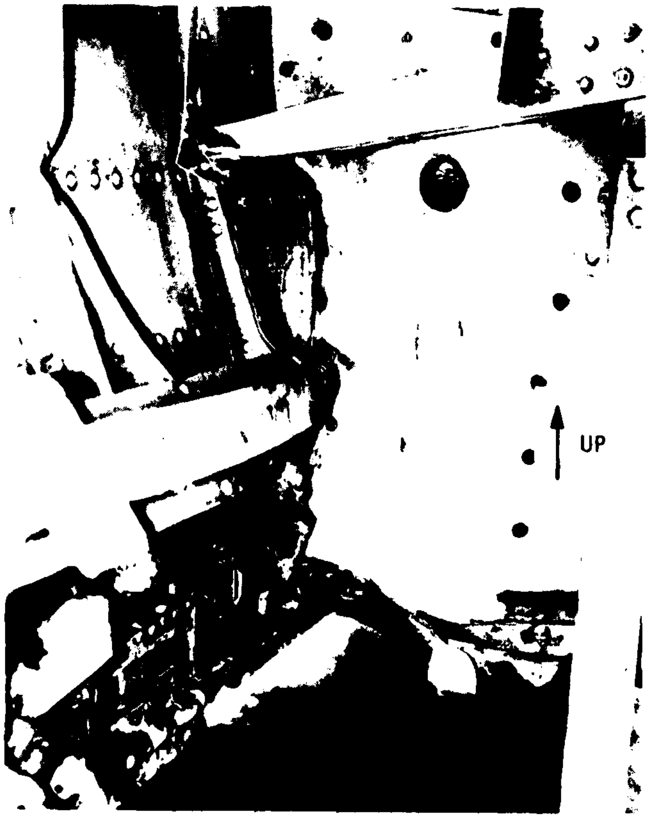


FIGURE 5-8. CLOSE UP VIEW OF VERTICAL KEEL AND FS960 BULKHEAD INTERSECTION

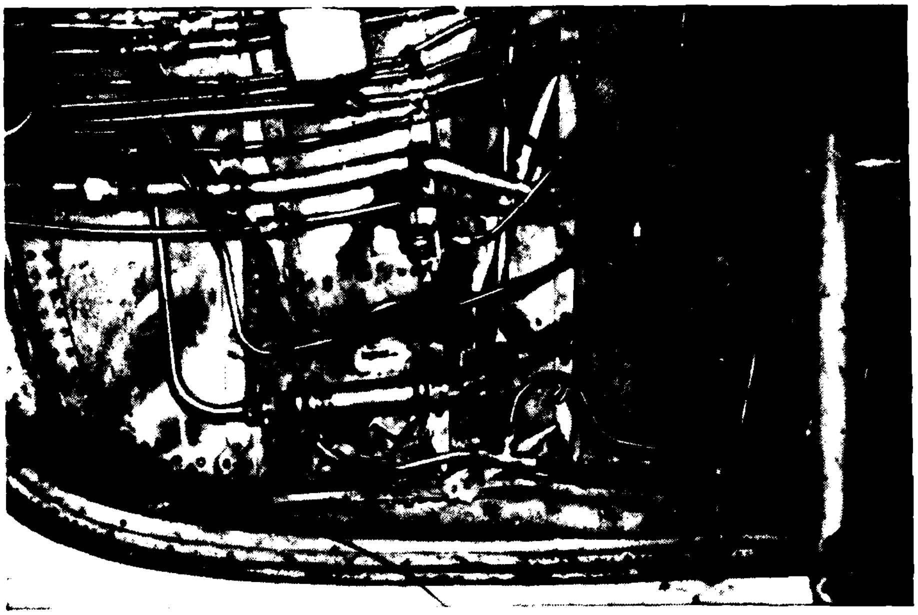


FIGURE 5-9. LEFT HAND LANDING GEAR WHEEL WELL -
FS820 BULKHEAD, LOOKING FORWARD

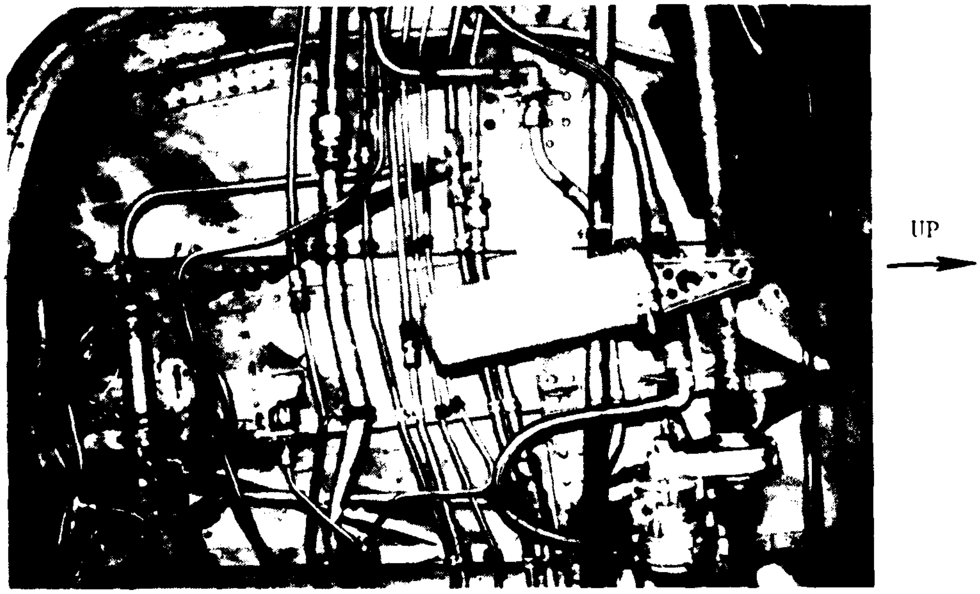


FIGURE 5-10. LEFT HAND LANDING GEAR WHEEL WELL -
FS820 BULKHEAD - TRACING WEB CRACK

FIGURE 5-11. LEFT HAND LANDING GEAR WHEEL WELL - FS820 TRACING WEB CRACK TO FLOOR

FIGURE 5-12. LEFT HAND LANDING GEAR WHEEL WELL - FS820 BULKHEAD - FLOOR INTERSECTION

FIGURE 5-13. CENTERLINE FRAME FRACTURE OF FS620 BULKHEAD - FORWARD CARGO BAY

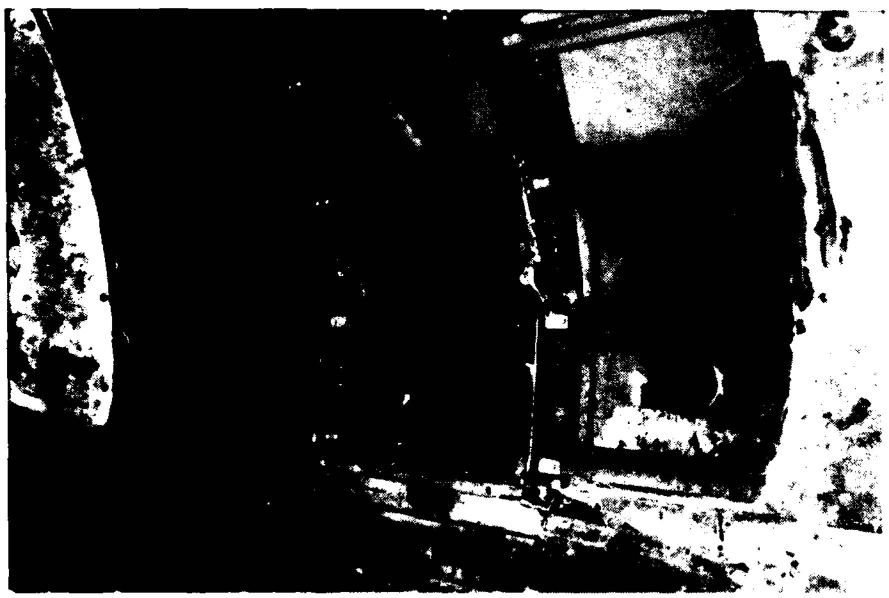


FIGURE 5-14. SIDEWALL FRAME DAMAGE AFT REGION OF FORWARD CARGO BAY (JUST FORWARD OF FS620)

FIGURE 5-15. AFT CARGO BAY LOOKING FORWARD TO FS960 BULKHEAD

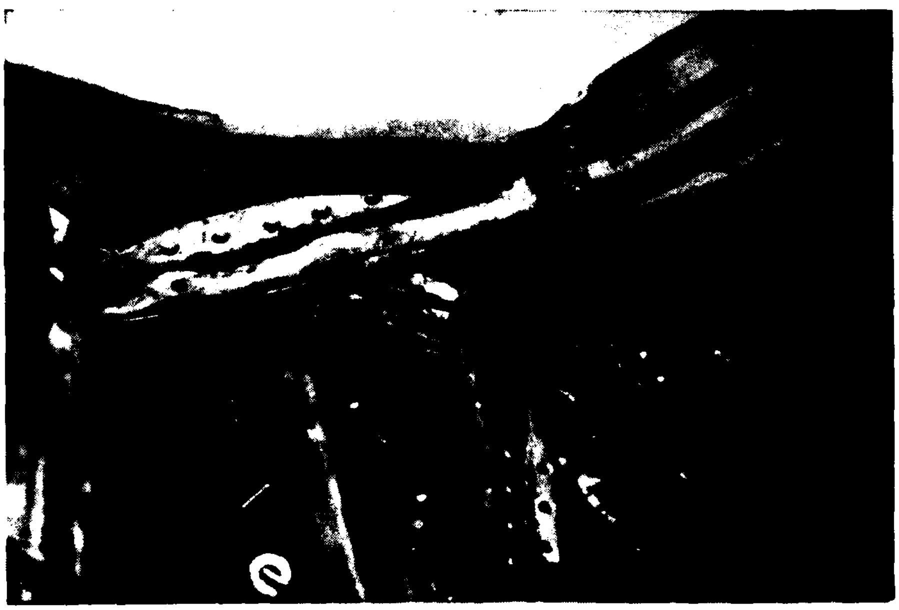


FIGURE 5-16. CLOSE UP VIEW OF STRINGER/DOUBLER FAILURE AT FS960 BULKHEAD

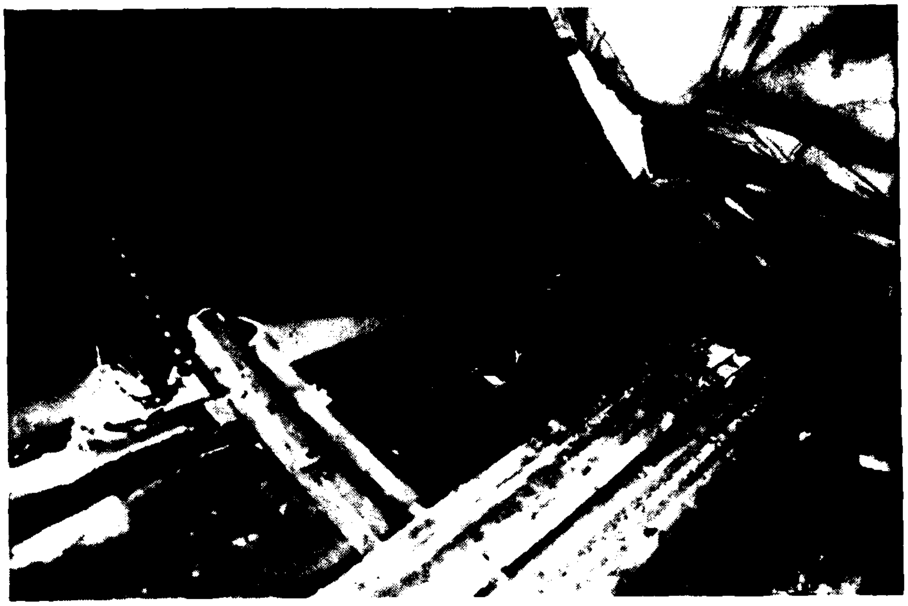


FIGURE 5-17. FS1010 - 1040 FRAME DAMAGE

FIGURE 5-18. FS1100 - 11[illegible]0 FRAME DAMAGE

more severe in the aft region as compared with the forward cargo bay. The relative severity of damage in the forward and aft region based on the analysis is consistent with the amount of crushing measured along the fuselage. From figure 5-19 it can be seen that the crushed ducting along the wing box keel (FS620-820) indicates that the structure had deflected at least 6 inches. Interior passenger floor damage is depicted in figures 5-20 through 5-24. The bulkhead at the wing trailing edge (FS820) ruptured and pushed the floor at that point up at least 4 inches at the center. The transverse beams and seat tracks have been severed. The frames between FS820 and 960 exhibit damage and an outboard bulge of the fuselage above the floor was noticeable after the impact. Since the onboard seats were not attached, but piled on the floor prior to the test, and no floor accelerations were recorded, it is difficult to ascertain the potential for seat failure throughout the airplane.

The test, conducted at Laurinburg, provided results with regard to structural damage and failure modes for a severe impact. Since the test lacked forward velocity and initial aerodynamic loading, there may be differences in responses when compared to the CID test. Bearing this fact in mind, the results were used to help refine the CID model prior to its planned test. The

FIGURE 5-19. LOWER WING BOX AND KEEL LEFT HAND SIDE VIEW SHOWS CRUSHED DUCTING

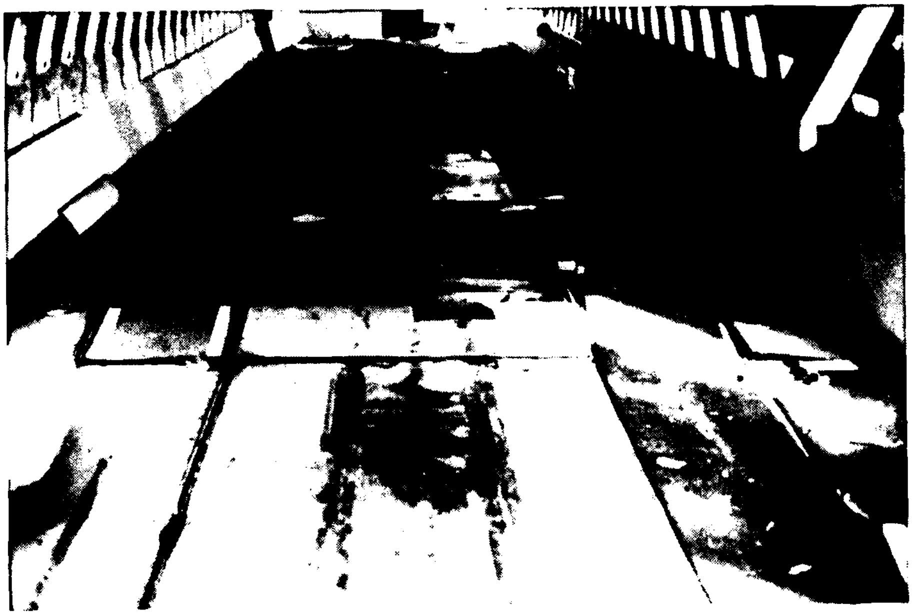


FIGURE 5-20. CABIN FLOOR LOOKING AFT - CENTER DECKING REMOVED FS820 TO FS940

Figure 5-21. CABIN FLOOR TRANSVERSE BEAMS - LOOKING AFT FROM FS820

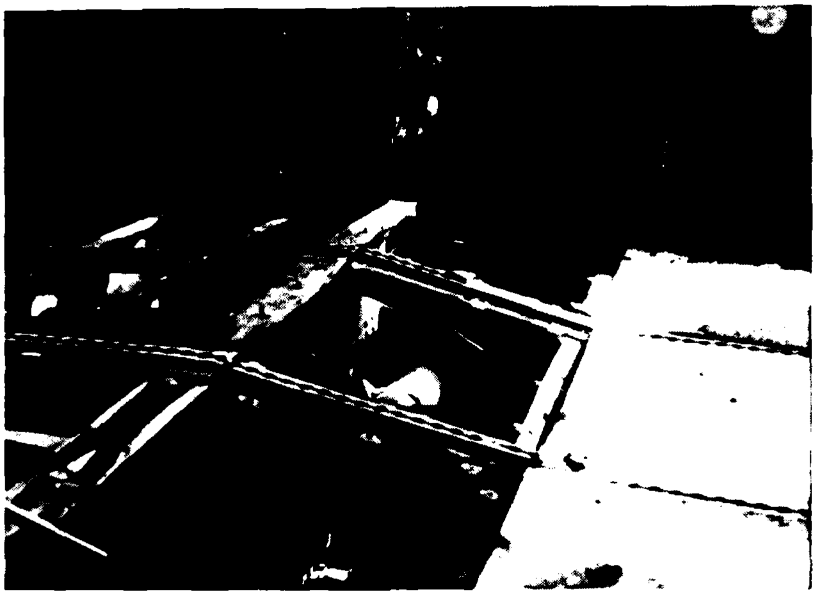


FIGURE 5-22. LOOKING AT LEFT HAND SIDE OF FS820 BULKHEAD

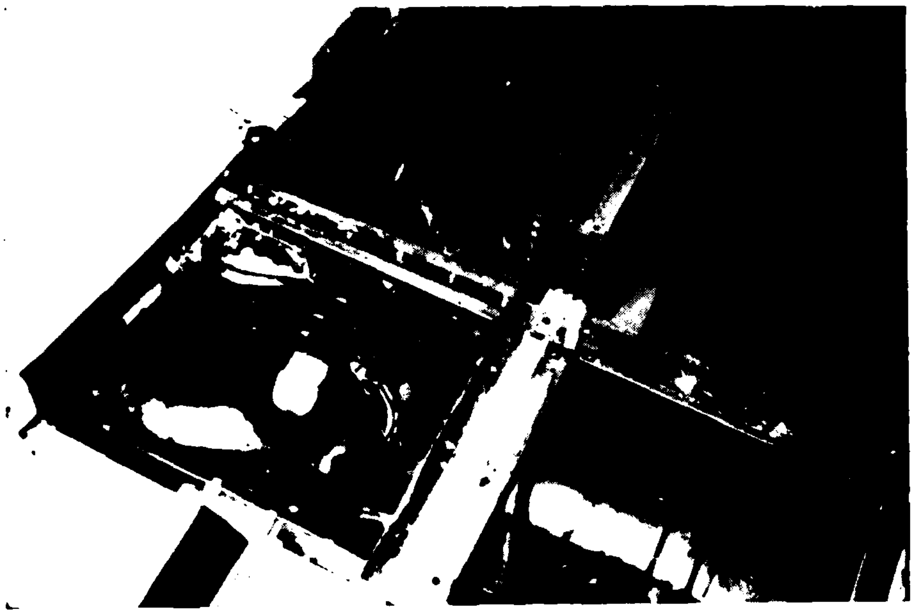


FIGURE 5-23. FRACTURES AT FS820 BULKHEAD AND CABIN FLOOR INTERFACE - RIGHT HAND SIDE VIEW

FIGURE 5-24. FRACTURE AT FS820 BULKHEAD AND CABIN FLOOR INTERFACE - CLOSE-UP VIEW

procedure, by which the results were incorporated into the modeling, is described in the following section.

5.2 KRASH MODELING OF IMPACT TEST

The CID KRASH stick model, shown in figure 4-2, was modified to reflect the longer B707 airplane. The appropriate weight and c.g. and the available shear and moment interaction curves were modified to reflect strength consistent with the increased size. The crush springs were modified to reflect both the appropriate crushing distribution, as well as the loads that might be experienced, as related to the damage shown in figures 5-3 through 5-24. The stick model results are compared to the test results in table 5-1.

One discrepancy noted in the analysis results versus that of the test is the extremely high moment-shear interaction curve values in the forward fuselage from FS460 to 620. The curves are based on compression failures and, thus, the high ratio exaggerates the damage. Nevertheless the analysis indicates more

TABLE 5-1. QUALITATIVE COMPARISON OF KRASH STICK MODEL AND B707 AIRPLANE IMPACT TEST

KRASH ANALYSIS RESULTS	TEST RESULTS
1. High Shear Loads in FS 820-960 Region	Keel damage FS 820-960 Bulkhead Damage at FS 820 and 960. See Figures 5-7 through 5-12 and 5-20 through 5-24.
2. No significant Bending Moment as evidence by low interaction curve levels, particularly in aft fuselage	Cargo Floor damage show evidence of crushing in lower region and frame failures. See Figures 5-13 through 5-18
3. Severe crushing of fuselage aft of MLG bulkhead FS 960 (5" to 6") crush forward of wing leading edge	Damage aft of FS 960 much more extensive than fwd of FS 620. See Figure 5-13 through 5-18, Figure 5-3 and 5-4
4. Approximately 6" to 9" inches of crush in wheel well region	6" Ducting in wheel well region shows evidence of complete crush. See Figure 5-19
5. Shows engine crushing accounts for approximately 10% of the total energy. Outboard engine also contacts ground and contributes to energy absorption	While the inboard engine fails at its upper attach points it remains lodged between wing and ground. See Figures 5-5 and 5-6

damage than is observed from a review of the post-test configuration. The stick model has limitations with regard to matching the level of detail damage experienced during the test. Since the fuselage is represented by only several mass points in the region of interest (FS 300-1200), the overall accelerations are lower than one might anticipate from the nature of abrupt failures noted. Local failures, such as shearing of webs, cannot be represented. Since one beam represents connectivity between major regions of structure, it is difficult for the input data to represent the overall nonlinearities. For example, major floor disruption locally, as occurred at FS820 during the test, would have to be represented by a beam rupture or highly nonlinear behavior. In the math model, this could result in separation of sections. In the test the upper fuselage shell maintains its integrity even though the floor has failed. The expanded CID model has more opportunity to represent discrete failures. However, even that model will have limitations for local failures. The contribution of the B707 impact test results is that it allows for a refinement to the crush representation of the fuselage frames and hard points. These refinements are shown in figures 5-25 and 5-26, respectively. The refinements evolved from several iterations using the KRASH stick model (figure 4-2). The purpose of the

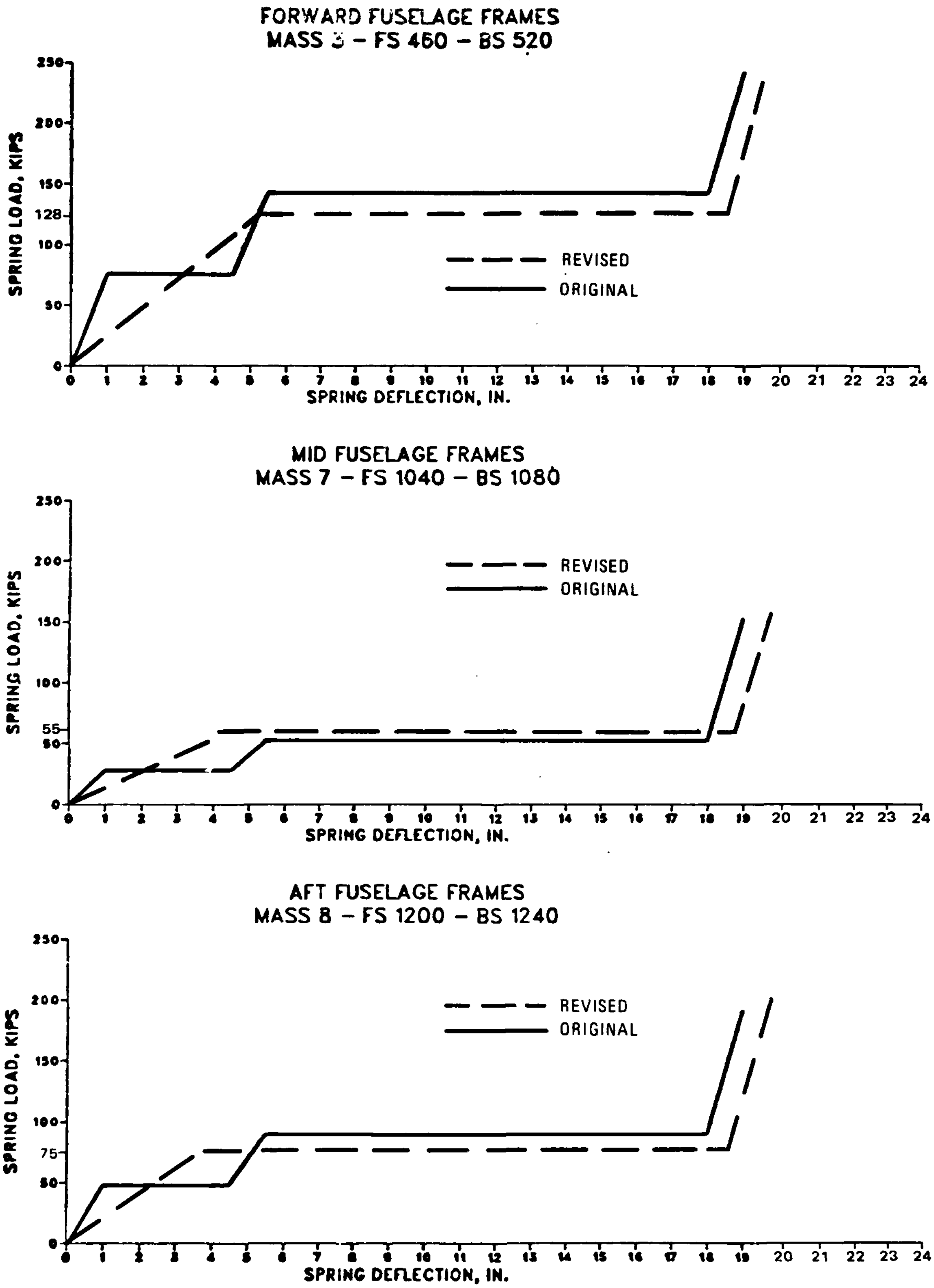


FIGURE 5-25. REVISIONS TO CID MODEL FRAME CRUSH SPRINGS

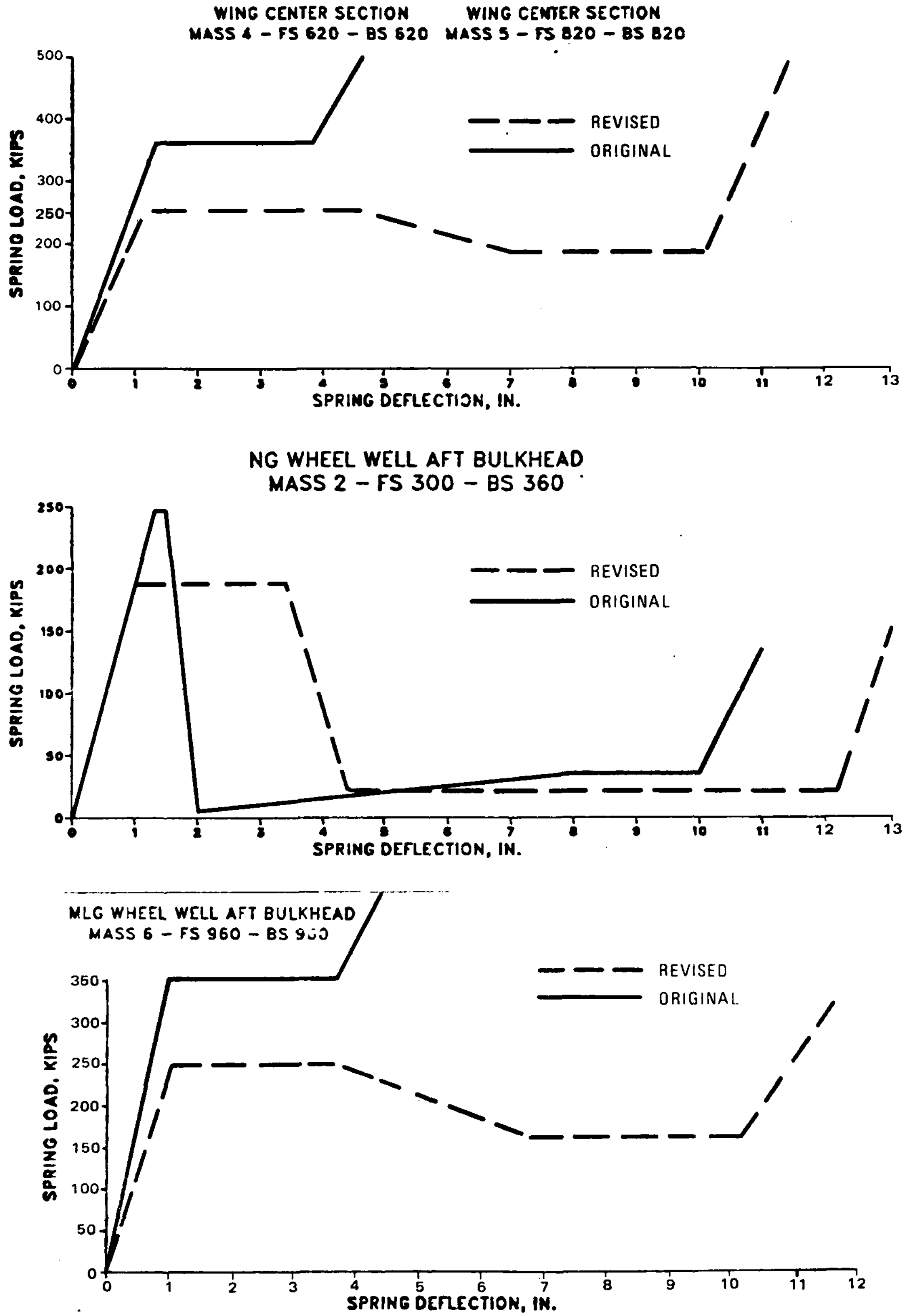


FIGURE 5-26. REVISIONS TO CID MODEL HARD POINT SPRINGS

computer runs was to match the observed fuselage crushing from the test. The most noticeable changes involved the hard point locations. The revised load-deflection curves for these locations (figure 5-26) allow for more deformation and energy absorption prior to restiffening. The frame springs, except for a minor modification in the forward fuselage region, were unchanged. It can be deduced from figures 5-25 and 5-26, that the most significant influence on the results comes from representation of hard point behavior. In particular, the bulkhead springs at FS960, 820 and 620 appear to be the driving forces which influence the damage results.

5.3 REVISED CID STICK MODEL RESULTS

Using the revised springs (figures 5-25 and 5-26) the CID stick model shown in figure 4-2, was rerun in the following conditions and sequence:

	Sink Speed Ft/Sec	Forward Velocity (Kts)	Lift
1.	17	0	0
2.	17	0	wing upload, tail download
3.	17	155	wing upload, tail download

The results for conditions one through three are similar to the B707 stick model results, but overall slightly higher. The addition of aerodynamic loading which induces an initial high tail down load and significant wing lift changes the characteristics of the responses somewhat. The most significant change is that the aft fuselage bending increases, while the contribution of shear loads from wing loading is lessened around the wing center box region. A comparison of analysis results for fuselage load-interaction curve (LIC) ratios, acceleration, and fuselage underside crush are shown in table 5-2. LIC values above one indicate that a potential for combined shear moment failure exists. These values are substantially lower than the preliminary results presented in Section 4. The LIC envelopes used in this analysis have higher allowables than those used in Section 4. The LIC envelopes are shown in figures 5-27 through 5-29. The dashed lines indicate the envelopes used in the KRASH

TABLE 5-2. COMPARISON OF ANALYSIS RESULTS △1

FS	B707*	CID CONDITIONS 1	CID CONDITIONS 2	CID CONDITIONS 3
Load Interaction Curve (LIC) Ratios △2				
350	0.81	0.79	0.69	0.84
620	0.81	0.85	0.83	1.10
960	0.54	0.51	0.68	0.79
990	0.55	0.55	0.80	0.97
1080	0.64	0.58	0.95	1.02
1160	0.72	0.67	0.94	1.05
1240	0.50	0.55	0.70	0.85
1320	0.56	0.53	0.68	0.74
1400	0.74	0.70	0.83	0.89
Peak Vertical Accelerations - g's △3				
300	15. (20.)	16. (19)	18.3 (18.6)	12.5 (17)
460	10.5 (12.7)	10.4 (13)	11.2 (12.8)	12.6 (12)
620	9.2 (9.8)	9.2 (9.8)	10.3 (9.6)	12.1 (9)
820	6.9 (8.0)	6.0 (8.0)	7.4 (8.2)	7.8 (8.5)
960	6.3 (7.6)	6.4 (7.5)	7.2 (8.4)	8. (8.6)
1040	6.5 (7.4)	5.6 (7.4)	6.6 (8.4)	8.6 (8.6)
1200	6.6 (7.8)	6.8 (7.2)	8. (8.2)	9.6 (10)
1400	10.2 (8.2)	9.4 (7.8)	9.5 (9.2)	14. (10)
Maximum Crushing - Inches				
300	5.7	5.2	4.	5.9
460	5.4	5.2	3.7	4.9
620	6.6	6.7	4.8	5.4
820	9.2	9.9	7.3	7.2
960	12.1	12.9	10.2	9.0
1040	14.5	13.5	11.	10.2
1200	7.1	5.7	3.4	2.3

1. 17 ft/sec sink speed, no aero, no fwd. velocity
2. 17 ft/sec sink speed, aero, no fwd, velocity
3. 17 ft/sec sink speed, aero, fwd. velocity

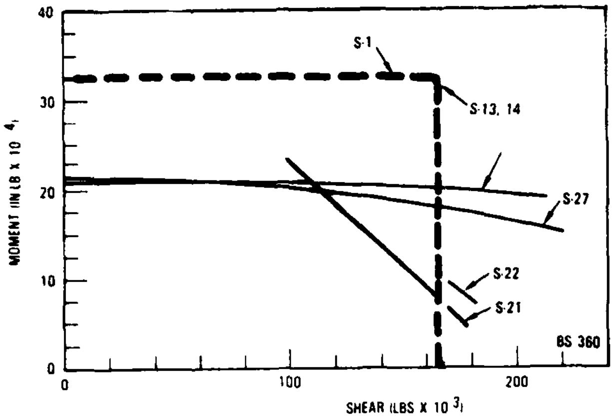
* 17 ft/sec, no aero, no fwd. velocity

△1 Maximum analysis time = 0.160 seconds

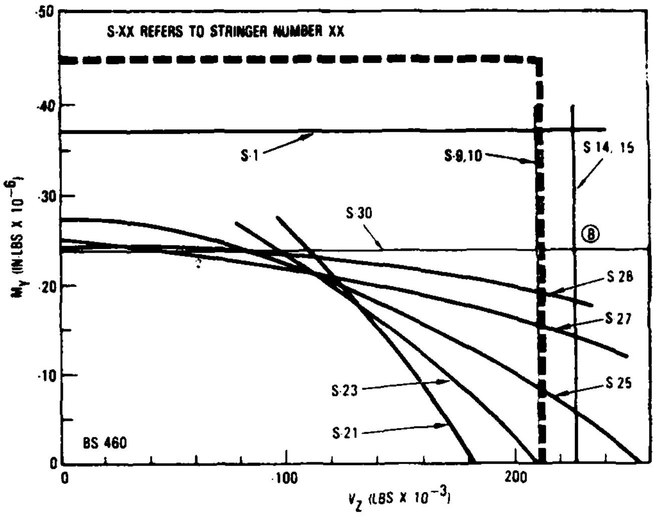
△2 Based on revised LIC curves (Figures 5-27 through 5-29)

△3 50 Hz filtered data

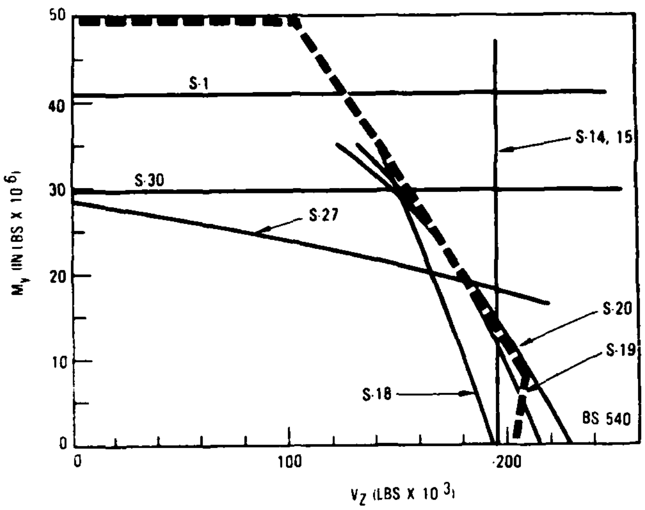
( ) Triangular Pulse Peak $\sim \frac{\text{Impluse} \times 2}{\Delta t}$



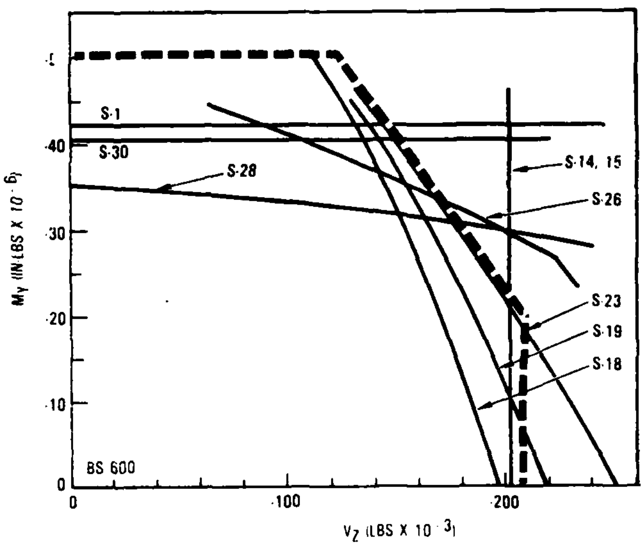
MAXIMUM ALLOWABLE MOMENT AND SHEAR ENVELOPE – NEGATIVE BENDING - B.S. 360



MAXIMUM ALLOWABLE MOMENT AND SHEAR ENVELOPE - NEGATIVE BENDING B.S. 460



MAXIMUM ALLOWABLE MOMENT AND SHEAR ENVELOPE - NEGATIVE BENDING - STA. 540



MAXIMUM ALLOWABLE MOMENT AND SHEAR ENVELOPE - NEGATIVE BENDING - B.S. 600

FIGURE 5-27. MAXIMUM ALLOWABLE MOMENT AND SHEAR ENVELOPE - NEGATIVE BENDING

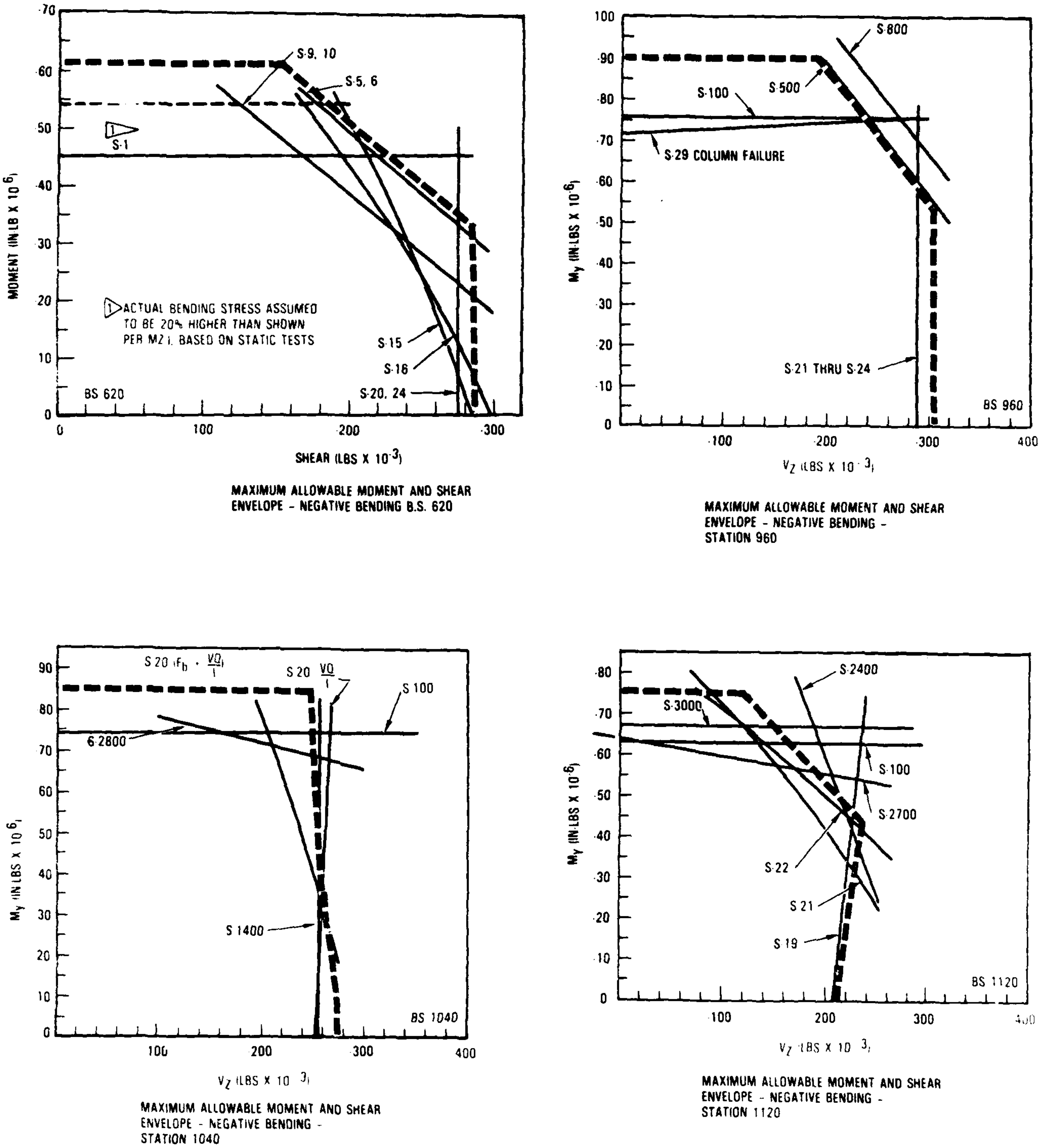
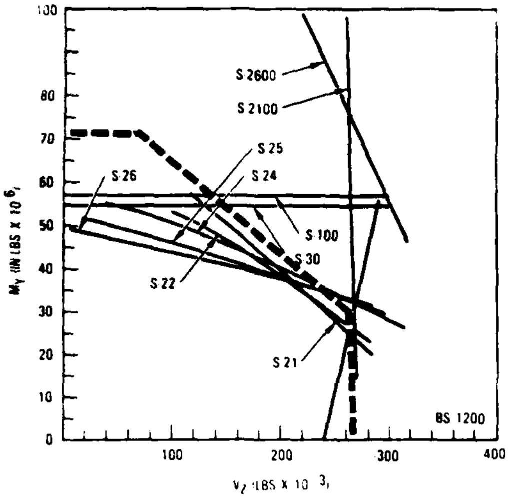
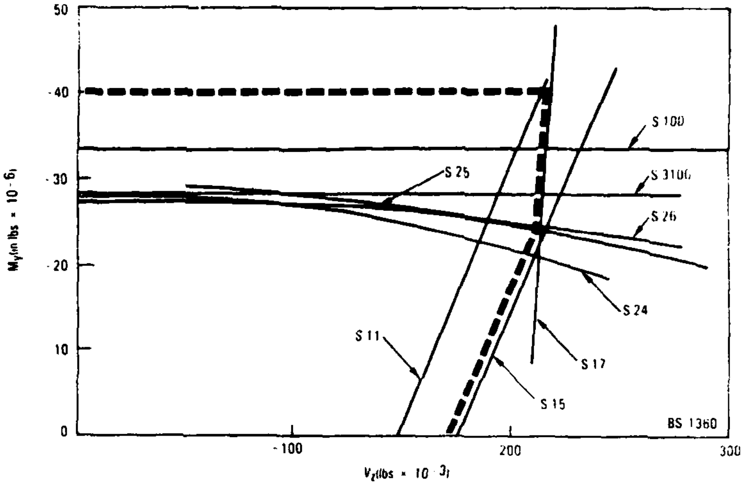


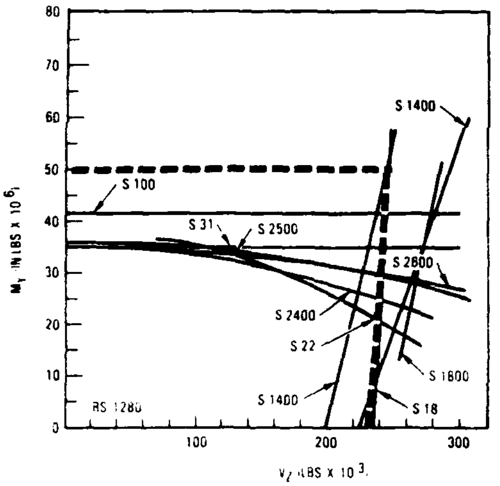
FIGURE 5-28. MAXIMUM ALLOWABLE MOMENT AND SHEAR ENVELOPE - NEGATIVE BENDING



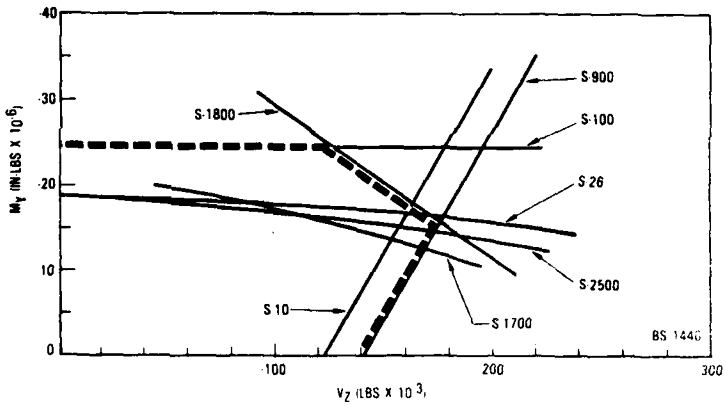
MAXIMUM ALLOWABLE MOMENT AND SHEAR ENVELOPE - NEGATIVE BENDING - STATION 1200



Maximum Allowable Moment and Shear Envelope - Negative Bending Station 1360



MAXIMUM ALLOWABLE MOMENT AND SHEAR ENVELOPE - NEGATIVE BENDING - STATION 1280



MAXIMUM ALLOWABLE MOMENT AND SHEAR ENVELOPE - NEGATIVE BENDING - STATION 1440

FIGURE 5-29. MAXIMUM ALLOWABLE MOMENT AND SHEAR ENVELOPE - NEGATIVE BENDING

analysis to obtain LIC ratios. The rationale behind the selection of the allowables was as follows:

- Critical failure would most likely occur due to tension at the fuselage upper crown (stringer 1) and due to shear at the side (S15-20), or due to some combination of moment and shear.
- Failure at the lower extremities of the fuselage (S30) is due to compression and thus not critical with regard to loss of fuselage structural integrity. Impact with the ground could easily account for crushing of several lower stringers without seriously jeopardizing the shell's protective capability.
- Where test results indicated a strength increase over analysis results, such data were used.

Figures 5-30 and 5-31 show comparisons of the KRASH stick model results between the use of the original load-deflection curves and LIC's (Section 4 Analysis) versus the revised load-deflection and LIC data described earlier in this section. The data envelope plotted includes the B707 Laurinburg drop test analysis as well as the three B720 conditions noted in Table 5-2. Figure 5-30 shows the peak vertical acceleration for the equivalent triangular pulse. As noted earlier the equivalent triangular pulse is obtained by integrating the acceleration data over the time period of interest. This yields an average acceleration, which when multiplied by two provides the equivalent peak for a triangular shaped pulse for the duration of the interval being considered. The presentation of the data in this form provides for a more consistent interpretation of the response. If only peaks are used then the question of whether the peak was plotted has to be resolved as well as how long the peak value is sustained. If filtered acceleration data is used then the filter characteristics (i.e., cut-off frequency and decay rate) can influence the results. From Figure 5-30 it can be observed that the revised load-deflection curve produce lower acceleration values. Since the revised curves tend to have lower peak forces, the aforementioned results appear to be consistent. The longitudinal pulse for condition no. 3 (Table 5-2) is also shown in Figure 5-30, since that is the only case run which included a forward velocity. The peak longitudinal acceleration is approximately 4g throughout the fuselage. Figure 5-31 compares the LIC ratios and crush distances. The results from the use of revised load-deflection data show lower LIC ratios and greater crush distances, both of which are consistent with the "Laurinburg" test results.

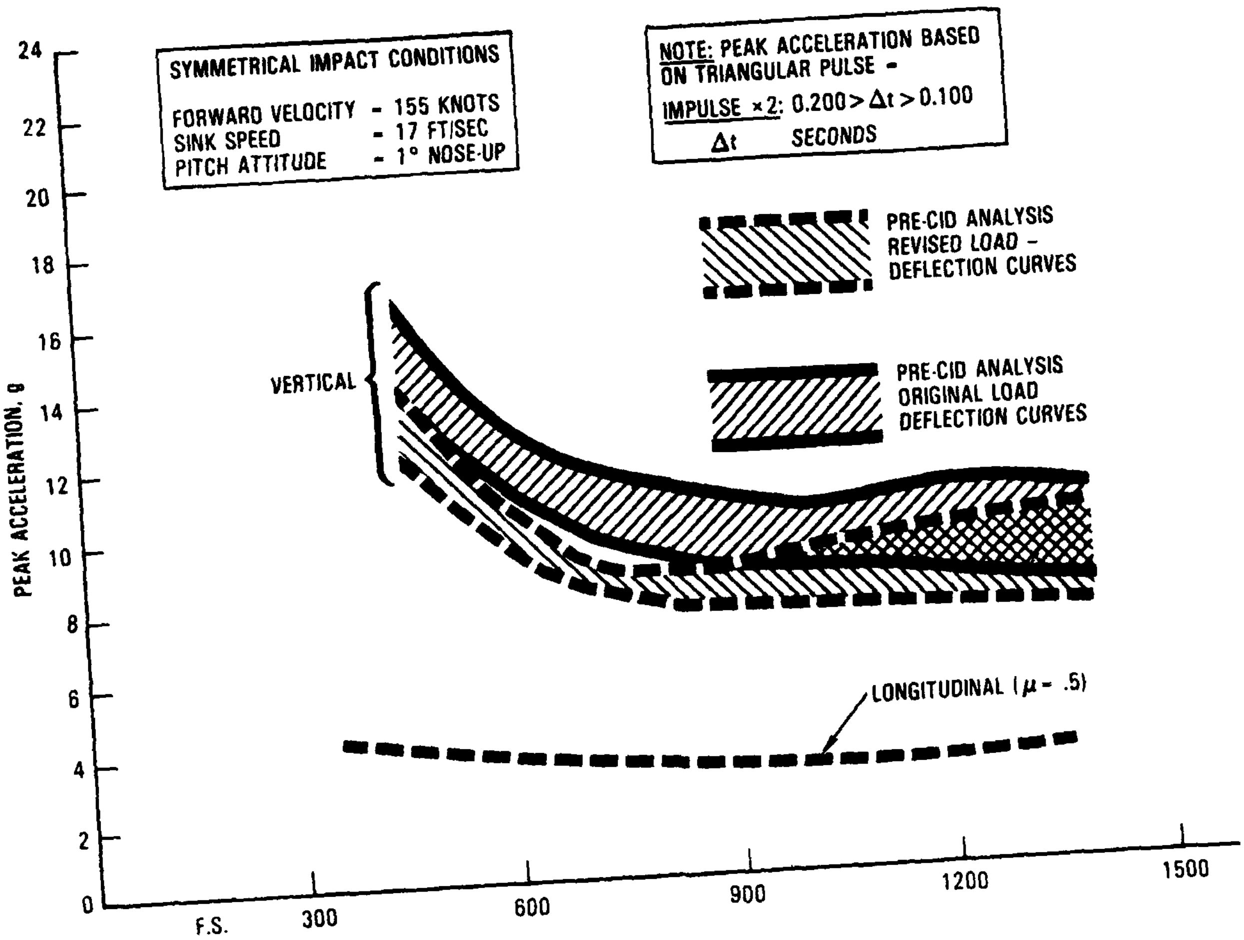


FIGURE 5-30. COMPARISON OF PRE-CID KRASH STICK MODEL ANALYSES ACCELERATION RESULTS — FOR PLANNED SYMMETRICAL IMPACT CONDITION, ORIGINAL VERSUS REVISED LOAD DEFLECTION CURVES

SYMMETRICAL IMPACT CONDITIONS

FORWARD VELOCITY - 155 KNOTS
SINK SPEED - 17 FT/SEC
PITCH ATTITUDE - 1° NOSE-UP

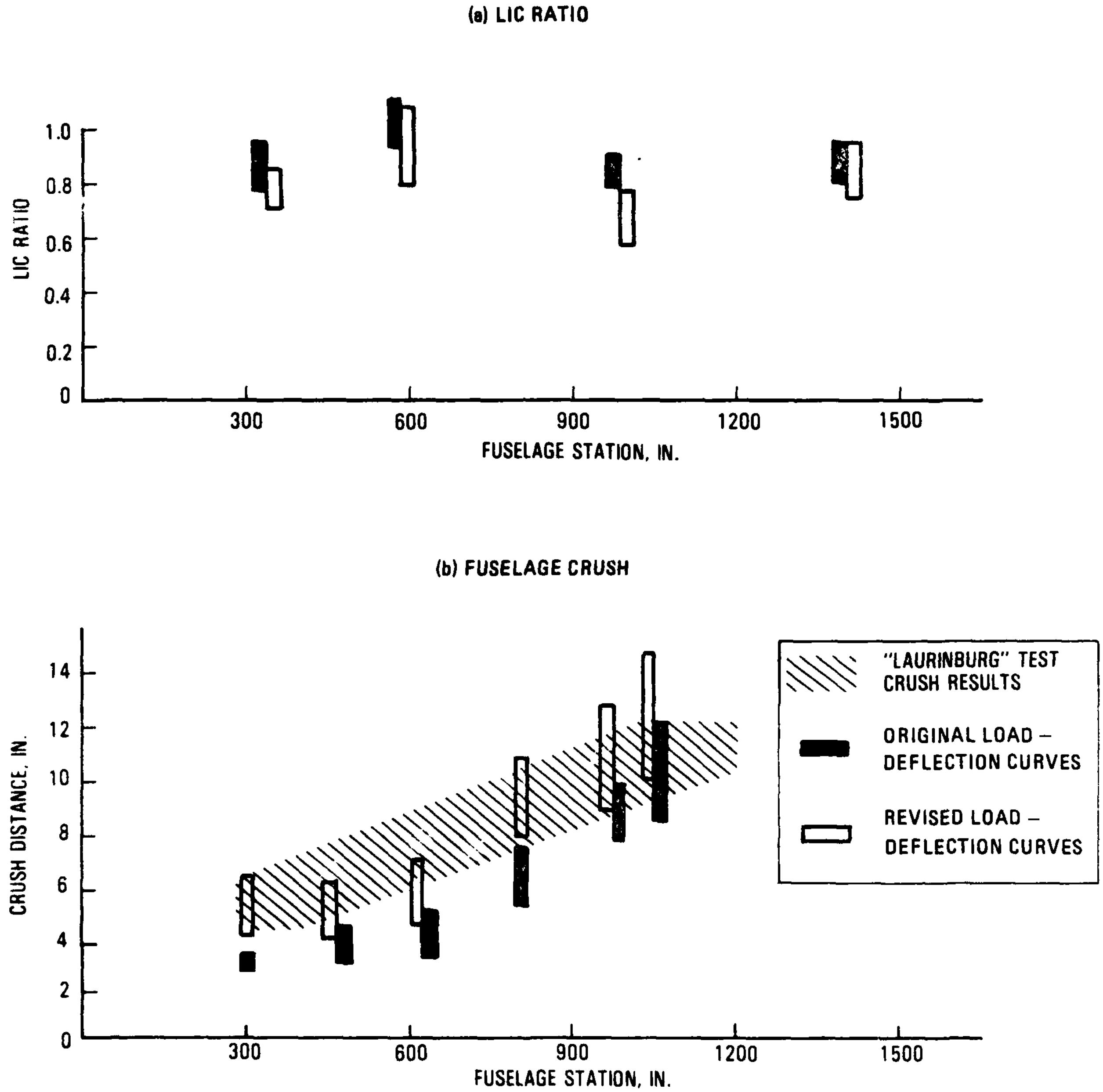


FIGURE 5-31. COMPARISON PRE-CID KRASH STICK MODEL LIC AND FUSELAGE CRUSH FOR THE PLANNED IMPACT CONDITION – ORIGINAL VERSUS REVISED LOAD-DEFLECTION CURVES

Figures 5-32 through 5-39 show representative KRASH analysis acceleration responses along the fuselage for condition no. 3, Table 5-2. From the data presented in these figures it can be observed that for the KRASH model results:

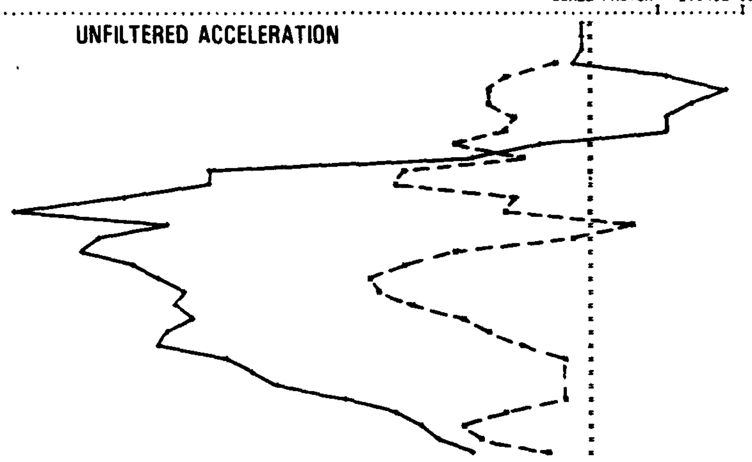
- differences exist in the peak acceleration values between unfiltered and filtered (50 Hz) data,
- at a particular location the pulse that is observed cannot always be described as a standard shape (i.e. triangular, trapezoidal),
- the plot interval selected may not provide the maximum value, and
- the impulse data provides a better indication of the overall pulse definition, and is independent of plot interval and/or filter characteristics.

Using the data at FS820 (figure 5-35), for example, the difference between plotted peak acceleration values is 7.753 g filtered vs 9.037 g unfiltered ($\sim$14 percent). The time history response indicates two or three acceleration peaks. However, from the mass impulse data an average acceleration of $\approx$4 g for a duration of .150 seconds can be surmised. An equivalent triangular pulse value of 8 g with a .150 second base duration is representative of the vertical pulse. Correspondingly, a 3.8 g triangular pulse of .150 second base duration is representative of longitudinal acceleration at this location. The response of the seat/occupant system is best evaluated in the manner described in Section 4.3, since the airframe pulse is not a definitive sinusoidal, trapezoidal or triangular shape.

MASS 2 UNFILTERED ACCELERATION(G'S)

SCALE FACTOR = 2.043E+00

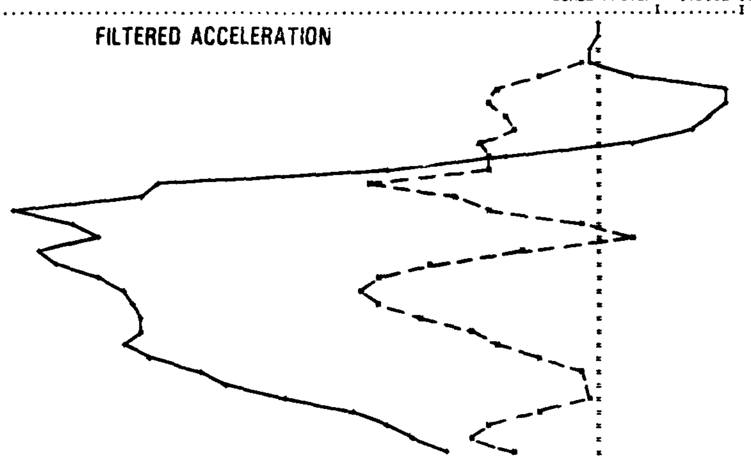
TIME(SEC)	XACC *	YACC =	ZACC +
0.0	8.604E-03	0.0	-5.437E-02
0.005	8.481E-03	0.0	-5.393E-02
0.010	-6.959E-02	0.0	-1.317E-01
0.015	-7.550E-01	0.0	-2.488E-01
0.020	-1.925E+00	0.0	2.014E+00
0.025	-2.427E+00	0.0	3.364E+00
0.030	-2.262E+00	0.0	2.487E+00
0.035	-1.704E+00	0.0	2.034E+00
0.040	-1.994E+00	0.0	1.920E+00
0.045	-3.114E+00	0.0	-1.110E+00
0.050	-1.464E+00	0.0	-2.747E+00
0.055	-4.469E+00	0.0	-9.015E+00
0.060	-6.657E+00	0.0	-9.061E+00
0.065	-1.812E+00	0.0	-1.111E+01
0.070	-1.944E+00	0.0	-1.380E+01
0.075	1.100E+00	0.0	-1.017E+01
0.080	-2.322E-01	0.0	-1.177E+01
0.085	-3.153E+00	0.0	-1.212E+01
0.090	-4.412E+00	0.0	-1.100E+01
0.095	-5.178E+00	0.0	-1.023E+01
0.100	-5.072E+00	0.0	-9.770E+00
0.105	-4.223E+00	0.0	-9.930E+00
0.110	-2.960E+00	0.0	-9.577E+00
0.115	-2.293E+00	0.0	-1.009E+01
0.120	-1.633E+00	0.0	-1.023E+01
0.125	-6.056E-01	0.0	-8.701E+00
0.130	8.196E-02	0.0	-8.038E+00
0.135	8.076E-02	0.0	-7.518E+00
0.140	-6.179E-01	0.0	-5.794E+00
0.145	-1.973E+00	0.0	-4.573E+00
0.150	-2.970E+00	0.0	-4.071E+00
0.155	-2.498E+00	0.0	-3.672E+00
0.160	-9.488E-01	0.0	-2.730E+00



MASS 2 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 1.813E+00

TIME(SEC)	XACCF *	YACCF =	ZACCF +
0.0	0.0	0.0	0.0
0.005	6.827E-03	0.0	-4.271E-02
0.010	-1.417E-02	0.0	-7.416E-02
0.015	-3.406E-01	0.0	-2.336E-01
0.020	-1.263E+00	0.0	7.028E-01
0.025	-2.091E+00	0.0	2.688E+00
0.030	-2.307E+00	0.0	2.737E+00
0.035	-2.003E+00	0.0	2.356E+00
0.040	-1.789E+00	0.0	2.004E+00
0.045	-2.602E+00	0.0	7.482E-01
0.050	-2.345E+00	0.0	-1.997E+00
0.055	-2.407E+00	0.0	-4.514E+00
0.060	-4.859E+00	0.0	-9.357E+00
0.065	-3.131E+00	0.0	-9.694E+00
0.070	-2.350E+00	0.0	-1.249E+01
0.075	-2.572E-01	0.0	-1.129E+01
0.080	8.269E-01	0.0	-1.065E+01
0.085	-1.551E+00	0.0	-1.202E+01
0.090	-3.570E+00	0.0	-1.153E+01
0.095	-4.690E+00	0.0	-1.071E+01
0.100	-5.050E+00	0.0	-1.007E+01
0.105	-4.662E+00	0.0	-9.884E+00
0.110	-3.701E+00	0.0	-9.783E+00
0.115	-2.774E+00	0.0	-9.836E+00
0.120	-2.096E+00	0.0	-1.022E+01
0.125	-1.219E+00	0.0	-9.508E+00
0.130	-3.460E-01	0.0	-8.442E+00
0.135	3.018E-02	0.0	-7.953E+00
0.140	-2.269E-01	0.0	-6.777E+00
0.145	-1.187E+00	0.0	-5.327E+00
0.150	-2.374E+00	0.0	-4.460E+00
0.155	-2.713E+00	0.0	-3.968E+00
0.160	-1.803E+00	0.0	-3.289E+00



MASS 2 MASS IMPULSES

SCALE FACTOR = 1.143E-01

TIME(SEC)	XIMP *	YIMP =	ZIMP +
0.0	0.0	0.0	0.0
0.005	2.181E-05	0.0	-1.363E-04
0.010	3.507E-05	0.0	-4.034E-04
0.015	-6.337E-04	0.0	-1.182E-03
0.020	-4.525E-03	0.0	-8.744E-04
0.025	-1.320E-02	0.0	8.188E-03
0.030	-2.445E-02	0.0	2.236E-02
0.035	-3.528E-02	0.0	3.512E-02
0.040	-4.451E-02	0.0	4.578E-02
0.045	-5.531E-02	0.0	5.384E-02
0.050	-6.863E-02	0.0	4.974E-02
0.055	-7.807E-02	0.0	3.664E-02
0.060	-9.824E-02	0.0	-2.544E-03
0.065	-1.189E-01	0.0	-4.873E-02
0.070	-1.317E-01	0.0	-1.041E-01
0.075	-1.384E-01	0.0	-1.647E-01
0.080	-1.353E-01	0.0	-2.181E-01
0.085	-1.370E-01	0.0	-2.756E-01
0.090	-1.506E-01	0.0	-3.349E-01
0.095	-1.715E-01	0.0	-3.903E-01
0.100	-1.961E-01	0.0	-4.421E-01
0.105	-2.207E-01	0.0	-4.918E-01
0.110	-2.418E-01	0.0	-5.412E-01
0.115	-2.578E-01	0.0	-5.899E-01
0.120	-2.699E-01	0.0	-6.402E-01
0.125	-2.782E-01	0.0	-6.903E-01
0.130	-2.819E-01	0.0	-7.346E-01
0.135	-2.825E-01	0.0	-7.756E-01
0.140	-2.827E-01	0.0	-8.127E-01
0.145	-2.860E-01	0.0	-8.427E-01
0.150	-2.951E-01	0.0	-8.669E-01
0.155	-3.084E-01	0.0	-8.878E-01
0.160	-3.200E-01	0.0	-9.061E-01

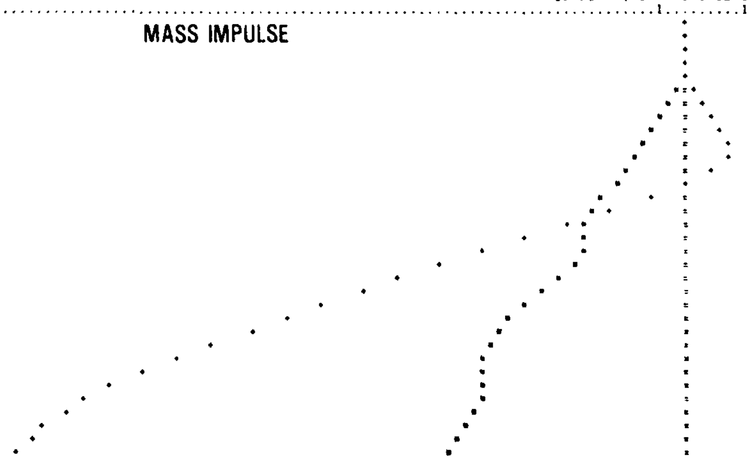
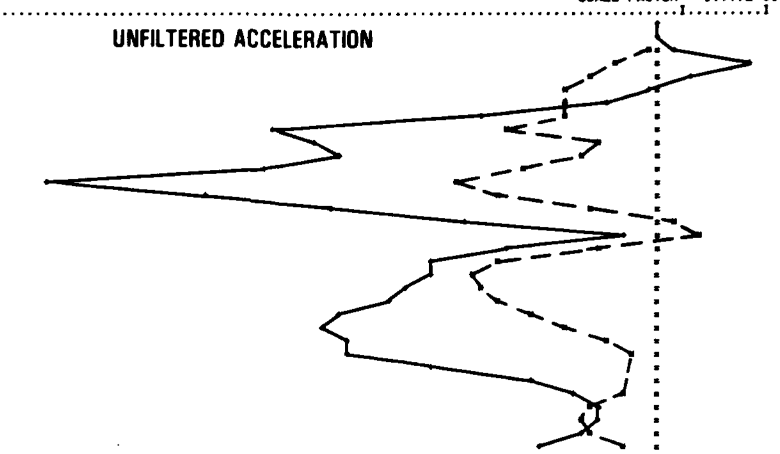


FIGURE 5-32. ACCELERATION RESPONSE AT FS300, CONDITION NO. 3

MASS 3 UNFILTERED ACCELERATION(G'S)

SCALE FACTOR = 1.997E+00

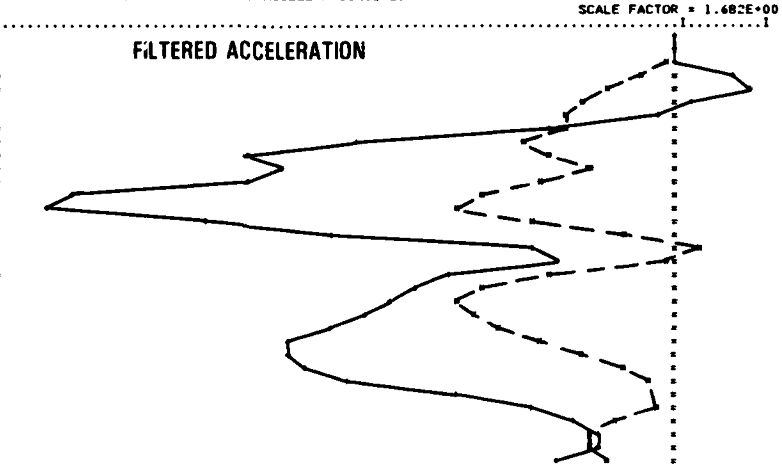
TIME(SEC)	XACC *	YACC =	ZACC +
0.0	9.093E-03	0.0	-4.600E-02
0.005	2.616E-03	0.0	-5.256E-02
0.010	-3.254E-01	0.0	2.817E-01
0.015	-1.117E+00	0.0	2.128E+00
0.020	-1.569E+00	0.0	8.036E-01
0.025	-2.174E+00	0.0	-1.800E-01
0.030	-2.284E+00	0.0	-1.184E+00
0.035	-2.354E+00	0.0	-4.282E+00
0.040	-3.648E+00	0.0	-9.323E+00
0.045	-1.543E+00	0.0	-8.350E+00
0.050	-1.905E+00	0.0	-7.748E+00
0.055	-3.324E+00	0.0	-9.519E+C0
0.060	-4.796E+00	0.0	-1.465E+01
0.065	-3.931E+00	0.0	-1.076E+01
0.070	-1.577E+00	0.0	-7.925E+00
0.075	2.626E-01	0.0	-4.605E+00
0.080	9.700E-01	0.0	-8.401E-01
0.085	-1.477E+00	0.0	-3.683E+00
0.090	-3.884E+00	0.0	-5.513E+00
0.095	-4.398E+00	0.0	-5.367E+00
0.10G	-4.359E+00	0.0	-6.018E+00
0.105	-3.802E+00	0.0	-6.440E+00
0.110	-3.106E+00	0.0	-7.591E+00
0.115	-2.191E+00	0.0	-8.035E+00
0.120	-1.209E+00	0.0	-7.415E+00
0.125	-6.365E-01	0.0	-7.372E+00
0.130	-1.125E-01	0.0	-5.469E+00
0.135	-1.041E-02	0.0	-3.062E+00
0.140	-7.789E-01	0.0	-2.144E+00
0.145	-1.624E+00	0.0	-1.482E+00
0.150	-1.903E+00	0.0	-1.378E+00
0.155	-1.652E+00	0.0	-1.770E+00
0.160	-8.223E-01	0.0	-2.892E+00



MASS 3 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 1.682E+00

TIME(SEC)	XACCF *	YACCF =	ZACCF +
0.0	0.0	0.0	0.0
0.005	6.388E-03	0.0	-3.762E-02
0.010	-1.152E-01	0.0	3.520E-02
0.015	-6.798E-01	0.0	1.148E+00
0.020	-1.262E+00	0.0	1.521E+00
0.025	-1.796E+00	0.0	2.612E-01
0.030	-2.213E+00	0.0	-3.786E-01
0.035	-2.177E+00	0.0	-2.494E+00
0.040	-3.070E+00	0.0	-6.451E+00
0.045	-2.564E+00	0.0	-8.652E+00
0.050	-1.695E+00	0.0	-7.855E+00
0.055	-2.624E+00	0.0	-8.489E+00
0.060	-3.932E+00	0.0	-1.203E+01
0.065	-4.395E+00	0.0	-1.261E+01
0.070	-2.809E+00	0.0	-9.408E+00
0.075	-9.196E-01	0.0	-6.942E+00
0.080	5.335E-01	0.0	-2.843E+00
0.085	-1.921E-01	0.0	-2.431E+00
0.090	-2.538E+00	0.0	-4.581E+00
0.095	-3.921E+00	0.0	-5.221E+00
0.100	-4.307E+00	0.0	-5.638E+00
0.105	-4.102E+00	0.0	-6.153E+00
0.110	-3.519E+00	0.0	-6.901E+00
0.115	-2.760E+00	0.0	-7.792E+00
0.120	-1.801E+00	0.0	-7.646E+00
0.125	-1.032E+00	0.0	-7.472E+00
0.130	-4.592E-01	0.0	-6.598E+00
0.135	-7.668E-02	0.0	-4.415E+00
3.140	-3.679E-01	0.0	-2.838E+00
0.145	-1.139E+00	0.0	-1.950E+00
0.150	-1.704E+00	0.0	-1.479E+00
0.155	-1.751E+00	0.0	-1.553E+00
0.160	-1.336E+00	0.0	-2.309E+00



MASS 3 MASS IMPULSES

SCALE FACTOR = 9.042E-02

TIME(SEC)	XIMP *	YIMP =	ZIMP +
0.0	0.0	0.0	0.0
0.005	2.287E-05	0.0	-1.169E-04
0.010	-1.220E-04	0.0	-2.691E-04
0.015	-1.990E-03	0.0	2.212E-03
0.020	-6.981E-03	0.0	1.013E-02
0.025	-1.460E-02	0.0	1.424E-02
0.030	-2.486E-02	0.0	1.416E-02
0.035	-3.579E-02	0.0	7.425E-03
0.040	-4.863E-02	0.0	-1.437E-02
0.045	-6.388E-02	0.0	-5.464E-02
0.050	-7.361E-02	0.0	-9.566E-02
0.055	-8.470E-02	0.0	-1.359E-01
0.060	-1.005E-01	0.0	-1.862E-01
0.065	-1.223E-01	0.0	-2.510E-01
0.070	-1.407E-01	0.0	-3.054E-01
0.075	-1.499E-01	0.0	-3.468E-01
0.080	-1.503E-01	0.0	-3.708E-01
0.085	-1.483E-01	0.0	-3.817E-01
0.090	-1.552E-01	0.0	-3.997E-01
0.095	-1.721E-01	0.0	-4.248E-01
0.100	-1.929E-01	0.0	-4.518E-01
0.105	-2.142E-01	0.0	-4.814E-01
0.110	-2.333E-01	0.0	-5.137E-01
0.115	-2.490E-01	0.0	-5.508E-01
0.120	-2.604E-01	0.0	-5.897E-01
0.125	-2.673E-01	0.0	-6.274E-01
0.130	-2.709E-01	0.0	-6.632E-01
0.135	-2.721E-01	0.0	-6.908E-01
0.140	-2.729E-01	0.0	-7.083E-01
0.145	-2.766E-01	0.0	-7.201E-01
0.150	-2.840E-01	0.0	-7.284E-01
0.155	-2.928E-01	0.0	-7.358E-01
0.160	-3.008E-01	0.0	-7.452E-01

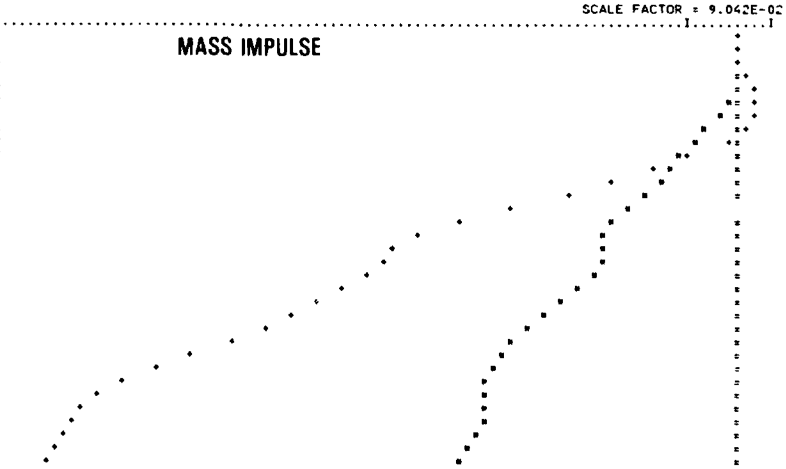
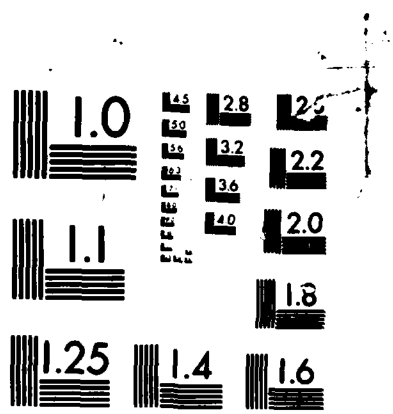


FIGURE 5-33. ACCELERATION RESPONSE AT FS460, CONDITION NO. 3

AD-A168 975 KRASH DYNAMICS ANALYSIS MODELING - TRANSPORT AIRPLANE CONTROLLED IMPACT D..(U) LOCKHEED AIRCRAFT CORP BURBANK CALIF G WITTLIN ET AL. MAR 86 LR-30776 DOT/FAA/CT-85/9 2/2

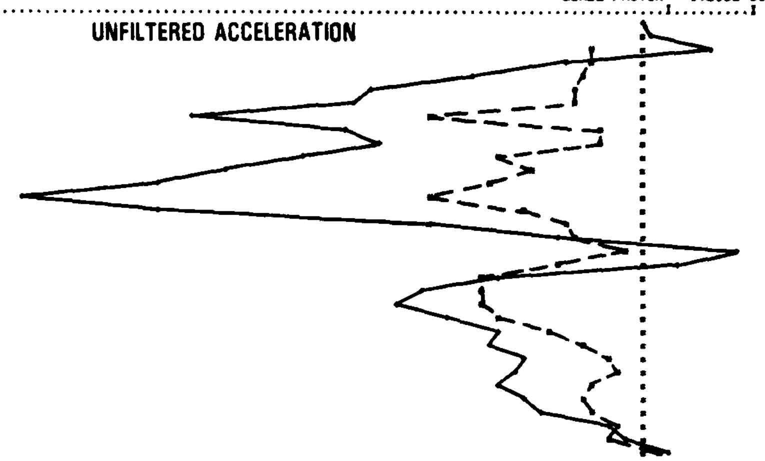
UNCLASSIFIED DTFA03-84-C-00004 F/G 1/2 NL


1.0
2.8
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6

MASS 4 UNFILTERED ACCELERATION(G'S)

SCALE FACTOR = 1.805E+00

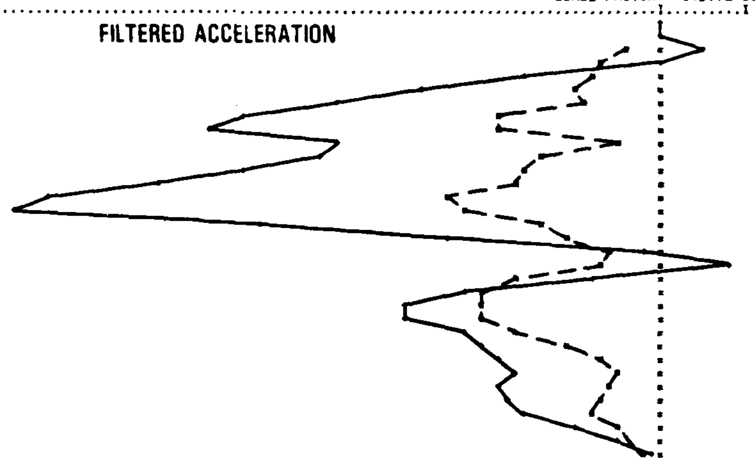
TIME(SEC)	XACC *	YACC *	ZACC +
0.0	9.252E-03	0.0	-3.799E-02
0.005	-1.274E-01	0.0	1.819E-01
0.010	-1.146E+00	0.0	1.296E+00
0.015	-1.191E+00	0.0	-1.675E+00
0.020	-1.415E+00	0.0	-3.708E+00
0.025	-1.567E+00	0.0	-5.915E+00
0.030	-1.457E+00	0.0	-6.186E+00
0.035	-4.621E+00	0.0	-9.704E+00
0.040	-9.555E-01	0.0	-6.328E+00
0.045	-9.927E-01	0.0	-5.568E+00
0.050	-3.143E+00	0.0	-7.200E+00
0.055	-2.372E+00	0.0	-8.933E+00
0.060	-3.259E+00	0.0	-1.033E+01
0.065	-4.590E+00	0.0	-1.324E+01
0.070	-2.678E+00	0.0	-1.037E+01
0.075	-1.661E+00	0.0	-4.543E+00
0.080	-1.422E+00	0.0	-1.926E+00
0.085	-4.368E-01	0.0	1.920E+00
0.090	-1.884E+00	0.0	7.293E-01
0.095	-3.583E+00	0.0	-3.200E+00
0.100	-3.473E+00	0.0	-4.703E+00
0.105	-3.454E+00	0.0	-5.329E+00
0.110	-3.160E+00	0.0	-4.274E+00
0.115	-2.053E+00	0.0	-3.195E+00
0.120	-1.258E+00	0.0	-3.318E+00
0.125	-7.579E-01	0.0	-2.639E+00
0.130	-6.693E-01	0.0	-2.803E+00
0.135	-1.068E+00	0.0	-3.176E+00
0.140	-1.314E+00	0.0	-2.635E+00
0.145	-1.100E+00	0.0	-2.173E+00
0.150	-5.445E-01	0.0	-7.870E-01
0.155	-7.073E-01	0.0	-4.996E-01
0.160	2.450E-01	0.0	3.872E-01



MASS 4 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 1.597E+00

TIME(SEC)	XACCF *	YACCF *	ZACCF +
0.0	0.0	0.0	0.0
0.005	-2.081E-02	0.0	1.929E-02
0.010	-6.015E-01	0.0	7.716E-01
0.015	-1.137E+00	0.0	-2.787E-02
0.020	-1.219E+00	0.0	-2.518E+00
0.025	-1.533E+00	0.0	-4.479E+00
0.030	-1.464E+00	0.0	-6.034E+00
0.035	-3.056E+00	0.0	-7.791E+00
0.040	-3.016E+00	0.0	-8.388E+00
0.045	-8.577E-01	0.0	-5.990E+00
0.050	-2.268E+00	0.0	-6.440E+00
0.055	-2.607E+00	0.0	-7.869E+00
0.060	-2.686E+00	0.0	-9.472E+00
0.065	-3.970E+00	0.0	-1.148E+01
0.070	-3.637E+00	0.0	-1.212E+01
0.075	-2.203E+00	0.0	-7.507E+00
0.080	-1.747E+00	0.0	-3.948E+00
0.085	-9.256E-01	0.0	-3.539E-01
0.090	-1.099E+00	0.0	1.292E+00
0.095	-2.690E+00	0.0	-1.224E+00
0.100	-3.394E+00	0.0	-3.635E+00
0.105	-3.418E+00	0.0	-4.852E+00
0.110	-3.367E+00	0.0	-4.822E+00
0.115	-2.663E+00	0.0	-3.729E+00
0.120	-1.755E+00	0.0	-3.390E+00
0.125	-1.101E+00	0.0	-3.015E+00
0.130	-7.448E-01	0.0	-2.708E+00
0.135	-8.716E-01	0.0	-3.040E+00
0.140	-1.176E+00	0.0	-2.890E+00
0.145	-1.208E+00	0.0	-2.473E+00
0.150	-8.585E-01	0.0	-1.634E+00
0.155	-7.291E-01	0.0	-8.385E-01
0.160	-2.581E-01	0.0	-7.965E-02



MASS 4 MASS IMPULSES

SCALE FACTOR = 7.828E-02

TIME(SEC)	XIMP *	YIMP =	ZIMP +
0.0	0.0	0.0	0.0
0.005	[illegible]	0.0	-5.999E-05
0.010	[illegible]	0.0	1.651E-03
0.015	[illegible]	0.0	5.007E-03
0.020	[illegible]	0.0	-1.949E-02
0.025	-1.879E-02	0.0	[illegible]
0.030	-2.620E-02	0.0	-4.658E-02
0.035	[illegible]	0.0	-7.931E-02
0.040	[illegible]	0.0	-1.226E-01
0.045	-6.189E-02	0.0	-1.571E-01
0.050	[illegible]	0.0	-1.874E-01
0.055	[illegible]	0.0	-2.221E-01
0.060	-9.500E-02	0.0	-2.668E-01
0.065	-1.117E-01	0.0	-3.186E-01
0.070	-1.318E-01	0.0	-3.801E-01
0.075	-1.460E-01	0.0	-4.296E-01
0.080	-1.557E-01	0.0	-4.573E-01
0.085	-1.624E-01	0.0	-4.681E-01
0.090	[illegible]	0.0	-4.637E-01
0.095	[illegible]	0.0	-4.628E-01
0.100	[illegible]	0.0	-4.757E-01
0.105	-2.090E-01	0.0	-4.974E-01
0.110	[illegible]	0.0	[illegible]
0.115	[illegible]	[illegible]	-5.435E-01
0.120	[illegible]	[illegible]	[illegible]
0.125	[illegible]	0.0	[illegible]
0.130	[illegible]	0.0	-5.912E-01
0.135	-2.676E-01	0.0	-6.055E-01
0.140	[illegible]	0.0	-6.206E-01
0.145	-2.789E-01	0.0	-6.340E-01
0.150	[illegible]	0.0	-6.446E-01
0.155	-2.879E-01	0.0	-6.502E-01
0.160	-2.906E-01	0.0	-6.526E-01

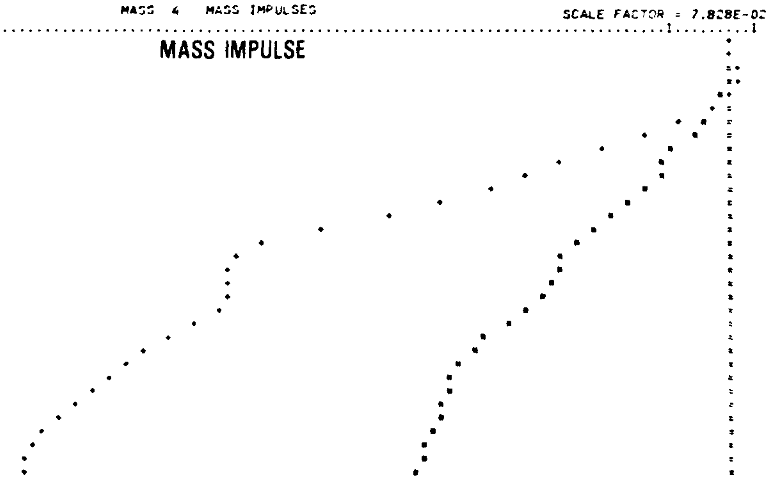
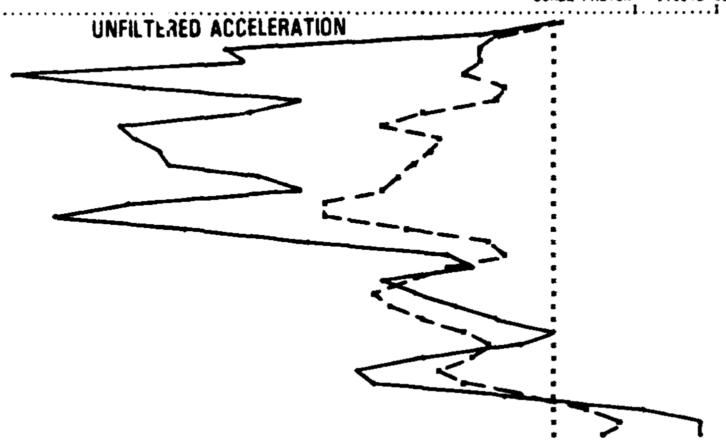


FIGURE 5-34. ACCELERATION RESPONSE AT FS620, CONDITION NO. 3

MASS 5 UNFILTERED ACCELERATION(G'S)

SCALE FACTOR = 1.359E+00

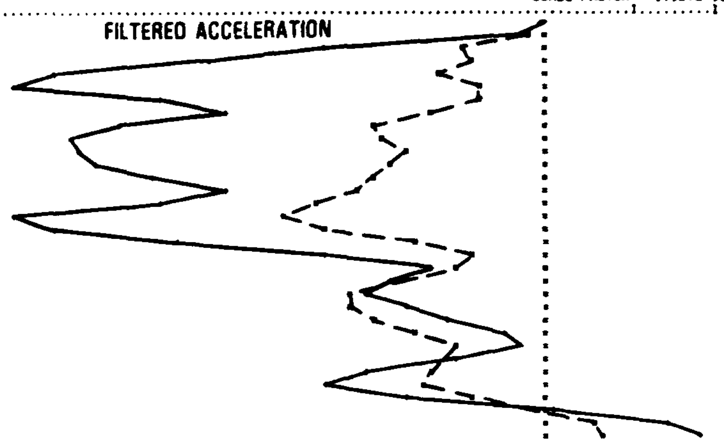
TIME(SEC)	XACC	YACC	ZACC
0.0	9.570E-03	0.0	-2.805E-02
0.005	-9.758E-01	0.0	-1.303E+00
0.010	-1.298E+00	0.0	-5.441E+00
0.015	-1.271E+00	0.0	-5.269E+00
0.020	-1.584E+00	0.0	-9.037E+00
0.025	-8.778E-01	0.0	-6.896E+00
0.030	-1.083E+00	0.0	-4.289E+00
0.035	-2.307E+00	0.0	-5.061E+00
0.040	-2.916E+00	0.0	-7.289E+00
0.045	-2.031E+00	0.0	-6.995E+00
0.050	-2.086E+00	0.0	-6.636E+00
0.055	-2.430E+00	0.0	-6.400E+00
0.060	-2.650E+00	0.0	-4.960E+00
0.065	-2.891E+00	0.0	-4.342E+00
0.070	-3.883E+00	0.0	-7.170E+00
0.075	-3.858E+00	0.0	-8.301E+00
0.080	-2.547E+00	0.0	-6.156E+00
0.085	[illegible]	0.0	-4.207E+00
0.090	-8.290E-01	0.0	-1.828E+00
0.095	-1.866E+00	0.0	-1.427E+00
0.100	-2.889E+00	0.0	-2.862E+00
0.105	-3.094E+00	0.0	-2.412E+00
0.110	-2.748E+00	0.0	-1.629E+00
0.115	-2.229E+00	0.0	-1.002E+00
0.120	-1.513E+00	0.0	-4.718E-02
0.125	-1.106E+00	0.0	-6.541E-01
0.130	-1.486E+00	0.0	-2.203E+00
0.135	-1.921E+00	0.0	-3.354E+00
0.140	-1.571E+00	0.0	-3.040E+00
0.145	-5.461E-01	0.0	-8.862E-01
0.150	5.146E-01	0.0	1.413E+00
0.155	9.722E-01	0.0	2.382E+00
0.160	7.611E-01	0.0	2.314E+00



MASS 5 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 1.189E+00

TIME(SEC)	XACCF	YACCF	ZACCF
0.0	0.0	0.0	0.0
0.005	-3.169E-01	0.0	-4.048E-01
0.010	-1.162E+00	0.0	-3.285E+00
0.015	-1.141E+00	0.0	-4.842E+00
0.020	-1.531E+00	0.0	-7.119E+00
0.025	-1.021E+00	0.0	-7.753E+00
0.030	-9.746E-01	0.0	-5.612E+00
0.035	-1.671E+00	0.0	-4.667E+00
0.040	-2.539E+00	0.0	-6.215E+00
0.045	-2.410E+00	0.0	-6.957E+00
0.050	-2.088E+00	0.0	-6.784E+00
0.055	-2.251E+00	0.0	-6.618E+00
0.060	-2.520E+00	0.0	-5.751E+00
0.065	-2.708E+00	0.0	-4.673E+00
0.070	-3.324E+00	0.0	-5.639E+00
0.075	-3.880E+00	0.0	-7.748E+00
0.080	-3.240E+00	0.0	-7.146E+00
0.085	-1.988E+00	0.0	-5.404E+00
0.090	-1.071E+00	0.0	-3.274E+00
0.095	-1.343E+00	0.0	-1.704E+00
0.100	-2.309E+00	0.0	-2.249E+00
0.105	-2.721E+00	0.0	-2.628E+00
0.110	-2.901E+00	0.0	-2.010E+00
0.115	-2.536E+00	0.0	-1.450E+00
0.120	-1.943E+00	0.0	-5.710E-01
0.125	-1.352E+00	0.0	-3.437E-01
0.130	-1.308E+00	0.0	-1.356E+00
0.135	-1.698E+00	0.0	-2.651E+00
0.140	-1.759E+00	0.0	-3.185E+00
0.145	-1.125E+00	0.0	-2.074E+00
0.150	-1.221E-01	0.0	5.370E-02
0.155	6.709E-01	0.0	1.738E+00
0.160	8.197E-01	0.0	2.231E+00



MASS 5 MASS IMPULSES

SCALE FACTOR = 7.171E-02

TIME(SEC)	XIMP	YIMP	ZIMP
0.0	0.0	0.0	0.0
0.005	-3.166E-04	0.0	-4.790E-04
0.010	[illegible]	0.0	-8.985E-03
0.015	-1.079E-02	0.0	-3.107E-02
0.020	-1.737E-02	0.0	-6.041E-02
0.025	-2.391E-02	0.0	[illegible]
0.030	-2.881E-02	0.0	-1.333E-01
0.035	-3.510E-02	0.0	-1.578E-01
0.040	-4.582E-02	0.0	-1.846E-01
0.045	-5.873E-02	0.0	[illegible]
0.050	-6.968E-02	0.0	-2.528E-01
0.055	-8.042E-02	0.0	-2.863E-01
0.060	[illegible]	0.0	-3.176E-01
0.065	[illegible]	0.0	-3.433E-01
0.070	[illegible]	0.0	-3.678E-01
0.075	[illegible]	0.0	-4.021E-01
0.080	-1.570E-01	0.0	-4.404E-01
0.085	-1.700E-01	0.0	-4.717E-01
0.090	-1.772E-01	0.0	-4.935E-01
0.095	-1.828E-01	0.0	-5.050E-01
0.100	[illegible]	0.0	-5.143E-01
0.105	-2.053E-01	0.0	-5.271E-01
0.110	-2.201E-01	0.0	-5.388E-01
0.115	-2.338E-01	0.0	-5.474E-01
0.120	-2.460E-01	0.0	-5.525E-01
0.125	-2.522E-01	0.0	-5.542E-01
0.130	-2.594E-01	0.0	-5.582E-01
0.135	-2.672E-01	0.0	-5.684E-01
0.140	-2.769E-01	0.0	-5.835E-01
0.145	-2.833E-01	0.0	-5.973E-01
0.150	-2.864E-01	0.0	-6.023E-01
0.155	-2.847E-01	0.0	-5.972E-01
0.160	-2.808E-01	0.0	-5.869E-01

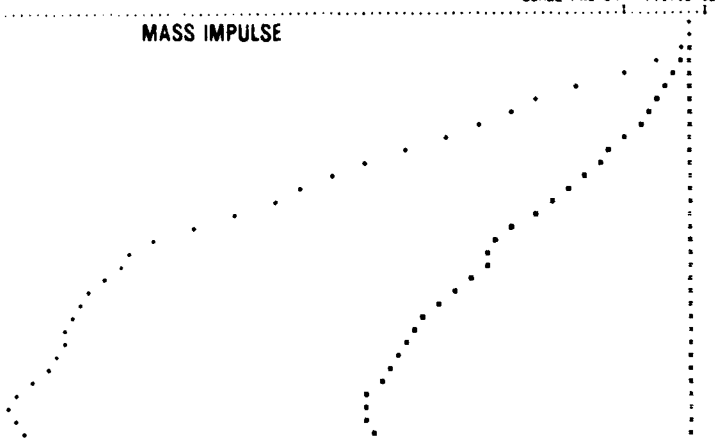
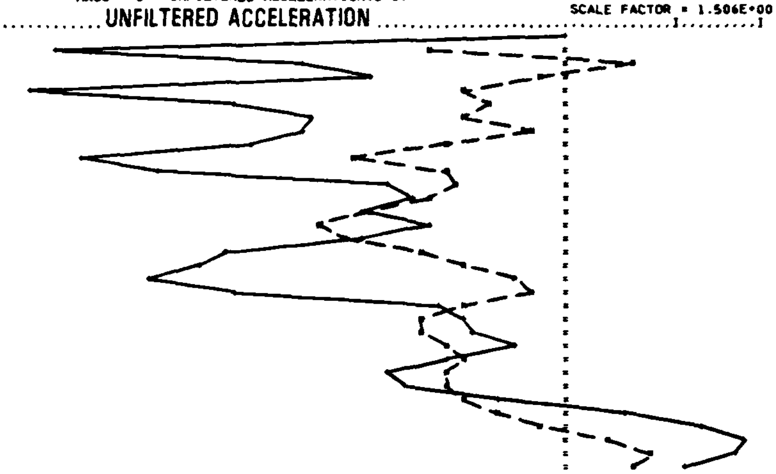


FIGURE 5-35. ACCELERATION RESPONSE AT FS820, CONDITION NO. 3

TIME(SEC)	XACC *	YACC *	ZACC *
0.0	8.991E-03	0.0	-2.236E-02
0.005	-2.492E+00	0.0	-9.048E+00
0.010	1.225E+00	0.0	-4.695E+00
0.015	-5.031E-01	0.0	-3.537E+00
0.020	-1.816E+00	0.0	-9.521E+00
0.025	-1.395E+00	0.0	-5.945E+00
0.030	-1.909E+00	0.0	-4.572E+00
0.035	-6.333E-01	0.0	-4.717E+00
0.040	-2.072E+00	0.0	-5.544E+00
0.045	-3.799E+00	0.0	-8.577E+00
0.050	-2.179E+00	0.0	-7.274E+00
0.055	-1.953E+00	0.0	-3.231E+00
0.060	-2.510E+00	0.0	-2.704E+00
0.065	-3.445E+00	0.0	-3.619E+00
0.070	-4.455E+00	0.0	-2.512E+00
0.075	-3.971E+00	0.0	-3.682E+00
0.080	-2.562E+00	0.0	-6.086E+00
0.085	-1.891E+00	0.0	-6.489E+00
0.090	-8.622E-01	0.0	-7.441E+00
0.095	-5.732E-01	0.0	-5.875E+00
0.100	-1.857E+00	0.0	-2.262E+00
0.105	-2.607E+00	0.0	-1.910E+00
0.110	-2.556E+00	0.0	-1.741E+00
0.115	-2.162E+00	0.0	-9.589E-01
0.120	-1.887E+00	0.0	-2.144E+00
0.125	-2.121E+00	0.0	-3.077E+00
0.130	-2.213E+00	0.0	-2.846E+00
0.135	-1.845E+00	0.0	-1.209E+00
0.140	-1.305E+00	0.0	9.582E-01
0.145	-4.541E-01	0.0	2.440E+00
0.150	6.934E-01	0.0	3.129E+00
0.155	1.454E+00	0.0	3.051E+00
0.160	1.113E+00	0.0	2.096E+00

MASS 6 UNFILTERED ACCELERATION(G'S)

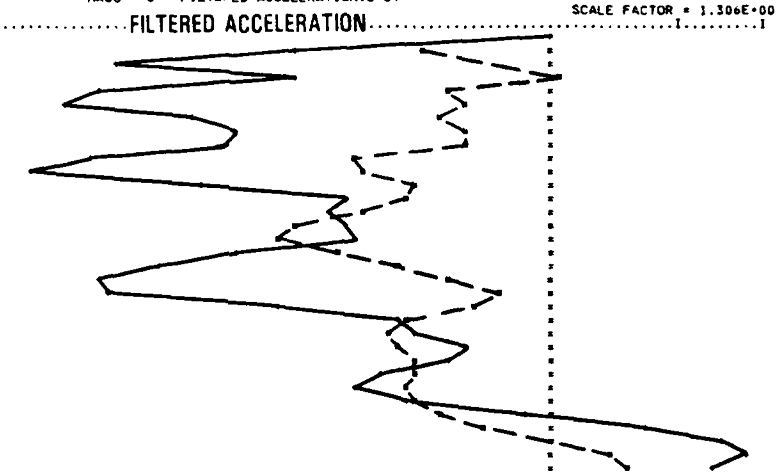
SCALE FACTOR = 1.506E+00



TIME(SEC)	XACCF *	YACCF *	ZACCF *
0.0	0.0	0.0	0.0
0.005	-1.926E+00	0.0	-3.946E+00
0.010	6.753E-02	0.0	-6.702E+00
0.015	1.646E-01	0.0	-3.894E+00
0.020	-1.554E+00	0.0	-6.904E+00
0.025	-1.326E+00	0.0	-7.464E+00
0.030	-1.667E+00	0.0	-5.525E+00
0.035	-1.256E+00	0.0	-4.763E+00
0.040	-1.253E+00	0.0	-4.912E+00
0.045	-3.002E+00	0.0	-7.041E+00
0.050	-2.869E+00	0.0	-7.949E+00
0.055	-2.085E+00	0.0	-5.315E+00
0.060	-2.259E+00	0.0	-3.172E+00
0.065	-2.877E+00	0.0	-3.328E+00
0.070	-3.879E+00	0.0	-3.076E+00
0.075	-4.215E+00	0.0	-2.937E+00
0.080	-3.299E+00	0.0	-4.863E+00
0.085	-2.357E+00	0.0	-6.055E+00
0.090	-1.512E+00	0.0	-6.865E+00
0.095	-7.258E-01	0.0	-6.837E+00
0.100	-1.210E+00	0.0	-4.164E+00
0.105	-2.164E+00	0.0	-2.301E+00
0.110	-2.520E+00	0.0	-2.035E+00
0.115	-2.368E+00	0.0	-1.318E+00
0.120	-2.035E+00	0.0	-1.534E+00
0.125	-2.015E+00	0.0	-2.631E+00
0.130	-2.178E+00	0.0	-2.991E+00
0.135	-2.041E+00	0.0	-2.138E+00
0.140	-1.628E+00	0.0	-3.096E-01
0.145	-9.783E-01	0.0	1.484E+00
0.150	3.685E-03	0.0	2.633E+00
0.155	9.904E-01	0.0	3.024E+00
0.160	1.185E+00	0.0	2.550E+00

MASS 6 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 1.306E+00



TIME(SEC)	XIMP *	YIMP *	ZIMP *
0.0	0.0	0.0	0.0
0.005	[illegible]	0.0	-6.813E-03
0.010	[illegible]	0.0	-3.847E-02
0.015	[illegible]	0.0	[illegible]
0.020	[illegible]	0.0	[illegible]
0.025	[illegible]	0.0	[illegible]
0.030	[illegible]	0.0	[illegible]
0.035	[illegible]	0.0	-1.841E-01
0.040	[illegible]	0.0	-2.079E-01
0.045	[illegible]	0.0	[illegible]
0.050	[illegible]	0.0	[illegible]
0.055	[illegible]	0.0	[illegible]
0.060	[illegible]	0.0	[illegible]
0.065	[illegible]	0.0	-3.460E-01
0.070	[illegible]	0.0	[illegible]
0.075	[illegible]	0.0	-3.767E-01
0.080	[illegible]	0.0	[illegible]
0.085	[illegible]	0.0	-4.239E-01
0.090	[illegible]	0.0	[illegible]
0.095	[illegible]	0.0	-4.914E-01
0.100	[illegible]	0.0	-5.194E-01
0.105	[illegible]	0.0	-5.344E-01
0.110	[illegible]	0.0	[illegible]
0.115	[illegible]	0.0	[illegible]
0.120	[illegible]	0.0	[illegible]
0.125	[illegible]	0.0	[illegible]
0.130	[illegible]	0.0	-5.851E-01
0.135	[illegible]	0.0	[illegible]
0.140	[illegible]	0.0	[illegible]
0.145	[illegible]	0.0	-6.014E-01
0.150	[illegible]	0.0	[illegible]
0.155	[illegible]	0.0	[illegible]
0.160	[illegible]	0.0	[illegible]

MASS 6 MASS IMPULSES

SCALE FACTOR = 7.198E-02

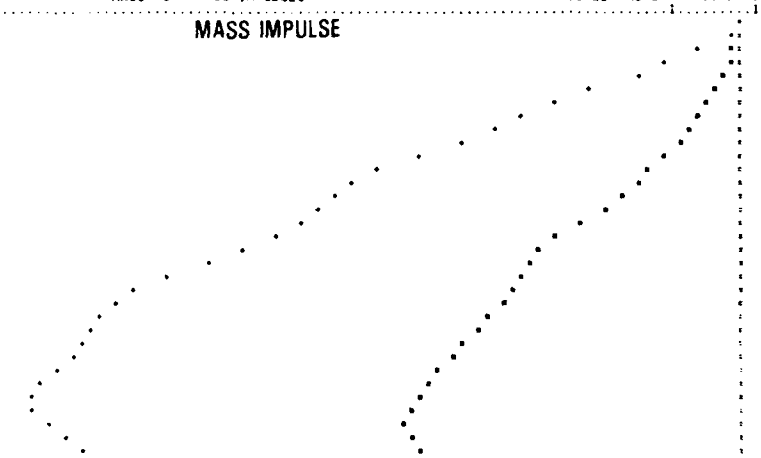
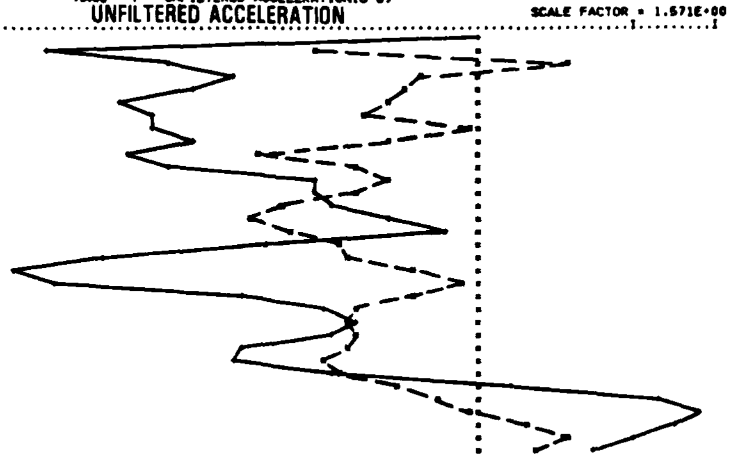


FIGURE 5-36. ACCELERATION RESPONSE AT FS960, CONDITION NO. 3

MASS 7 UNFILTERED ACCELERATION(G'S)

SCALE FACTOR = 1.571E+00

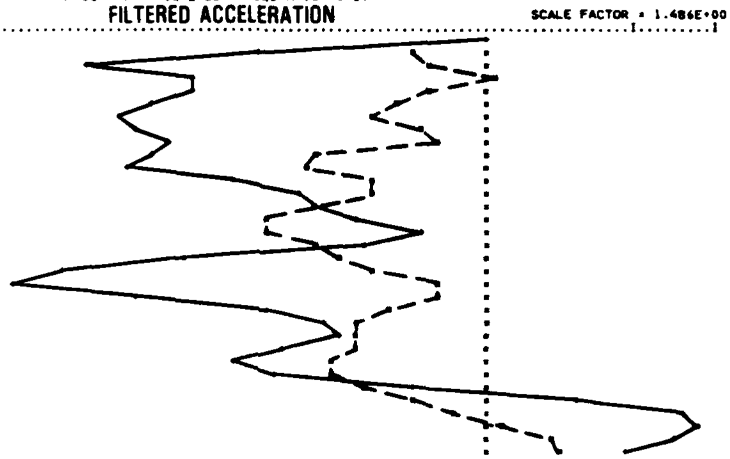
TIME(SEC)	XACC	YACC	ZACC
0.0	9.595E-05	0.0	-1.636E-02
0.005	-3.129E+00	0.0	-8.300E+00
0.010	1.822E+00	0.0	-5.978E+00
0.015	-1.102E+00	0.0	-6.752E+00
0.020	-1.417E+00	0.0	-5.413E+00
0.025	-1.770E+00	0.0	-6.860E+00
0.030	-2.092E+00	0.0	-6.296E+00
0.035	-1.338E-01	0.0	-6.226E+00
0.040	-1.718E+00	0.0	-5.662E+00
0.045	-4.201E+00	0.0	-6.685E+00
0.050	-2.387E+00	0.0	-5.881E+00
0.055	-1.618E+00	0.0	-3.149E+00
0.060	-2.393E+00	0.0	-3.058E+00
0.065	-3.697E+00	0.0	-2.845E+00
0.070	-4.336E+00	0.0	-1.619E+00
0.075	-3.561E+00	0.0	-6.006E-01
0.080	-2.593E+00	0.0	-4.114E+00
0.085	-2.415E+00	0.0	-7.245E+00
0.090	-1.255E+00	0.0	-8.919E+00
0.095	-2.923E-01	0.0	-8.089E+00
0.100	-1.291E+00	0.0	-4.469E+00
0.105	-2.300E+00	0.0	-3.028E+00
0.110	-2.479E+00	0.0	-2.355E+00
0.115	-2.278E+00	0.0	-2.847E+00
C.120	-2.448E+00	0.0	-4.530E+00
0.125	-2.950E+00	0.0	-4.615E+00
0.130	-2.625E+00	0.0	-2.718E+00
0.135	-1.587E+00	0.0	5.936E-01
0.140	-7.854E-01	0.0	3.503E+00
0.145	-7.145E-02	0.0	4.277E+00
0.150	9.317E-01	0.0	3.756E+00
0.155	1.705E+00	0.0	3.036E+00
0.160	1.137E+00	0.0	2.164E+00



MASS 7 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 1.486E+00

TIME(SEC)	XACCF	YACCF	ZACCF
0.0	0.0	0.0	0.0
0.005	-1.232E+00	0.0	-4.088E+00
0.010	-9.652E-01	0.0	-7.229E+00
0.015	2.626E-01	0.0	-5.324E+00
0.020	-9.685E-01	0.0	-5.245E+00
0.025	-1.544E+00	0.0	-6.064E+00
0.030	-2.065E+00	0.0	-6.578E+00
0.035	-1.077E+00	0.0	-6.308E+00
0.040	-7.841E-01	0.0	-5.768E+00
0.045	-3.029E+00	0.0	-6.087E+00
0.050	-3.172E+00	0.0	-6.448E+00
0.055	-2.011E+00	0.0	-4.496E+00
0.060	-2.039E+00	0.0	-3.316E+00
0.065	-2.957E+00	0.0	-3.051E+00
0.070	-3.950E+00	0.0	-2.367E+00
0.075	-3.961E+00	0.0	-1.065E+00
0.080	-3.103E+00	0.0	-2.224E+00
0.085	-2.614E+00	0.0	-5.456E+00
0.090	-1.962E+00	0.0	-7.731E+00
0.095	-8.030E-01	0.0	-8.557E+00
0.100	-8.173E-01	0.0	-6.353E+00
0.105	-1.752E+00	0.0	-4.005E+00
0.110	-2.315E+00	0.0	-2.897E+00
0.115	-2.345E+00	0.0	-2.572E+00
0.120	-2.334E+00	0.0	-3.654E+00
0.125	-2.692E+00	0.0	-4.532E+00
0.130	-2.807E+00	0.0	-3.767E+00
0.135	-2.155E+00	0.0	-1.345E+00
0.140	-1.284E+00	0.0	1.743E+00
0.145	-5.508E-01	0.0	3.652E+00
0.150	3.153E-01	0.0	3.921E+00
0.155	1.234E+00	0.0	3.425E+00
0.160	1.396E+00	0.0	2.622E+00



MASS 7 MASS IMPULSES

SCALE FACTOR = 7.506E-02

TIME(SEC)	XIMP	YIMP	ZIMP
0.0	0.0	0.0	0.0
0.005	-1.654E-03	0.0	6.083E-03
0.010	-1.087E-0[illegible]	0.0	3.977E-02
0.015	-9.159E-0[illegible]	0.0	7.066E-02
0.020	[illegible].179E-02	0.0	-9.643E-02
0.025	-1.822E-02	0.0	-1.242E-01
0.030	-2.746E-02	0.0	-1.568E-01
0.035	-2.592E-02	0.0	-1.887E-01
0.040	-2.926E-02	0.0	-2.191E-01
0.045	-4.878E-02	0.0	-2.481E-01
0.050	-6.565E-02	0.0	-2.802E-01
0.055	-7.82[illegible]E-02	0.0	-3.080E-01
0.060	-8.787E-02	0.0	-3.267E-01
0.065	-1.002E-01	0.0	-3.426E-01
0.070	-1.177E-01	0.0	-3.564E-01
0.075	-1.280E-01	0.0	-3.648E-01
0.080	-1.556E-01	0.0	-3.715E-01
0.085	-1.696E-01	0.0	-3.910E-01
0.090	-1.814E-01	0.0	-4.245E-01
0.095	-1.883E-01	0.0	-4.664E-01
0.100	-1.915E-01	0.0	-5.045E-01
0.105	-1.974E-01	0.0	-5.295E-01
0.110	-2.084E-01	0.0	-5.465E-01
0.115	-2.202E-01	0.0	-5.596E-01
0.120	-2.319E-01	0.0	-5.748E-01
0.125	-2.443E-01	0.0	-5.959E-01
0.130	-2.583E-01	0.0	-6.173E-01
0.135	-2.709E-01	0.0	-6.305E-01
0.140	-2.794E-01	0.0	-6.292E-01
0.145	-2.839E-01	0.0	-6.148E-01
0.150	-2.846E-01	0.0	-5.954E-01
0.155	-2.805E-01	0.0	-5.769E-01
0.160	-2.734E-01	0.0	-5.618E-01

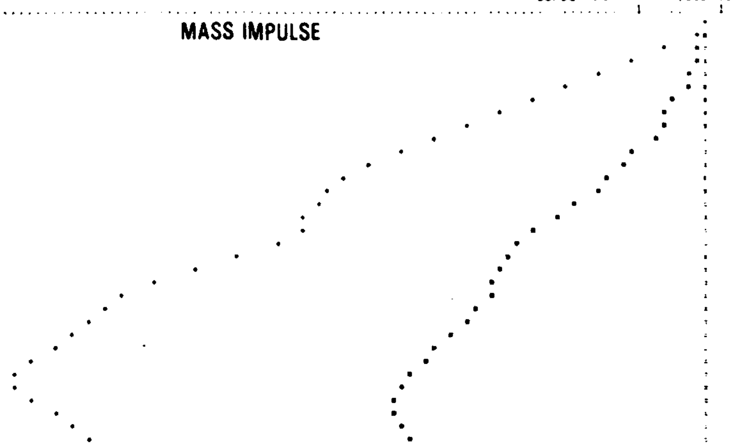
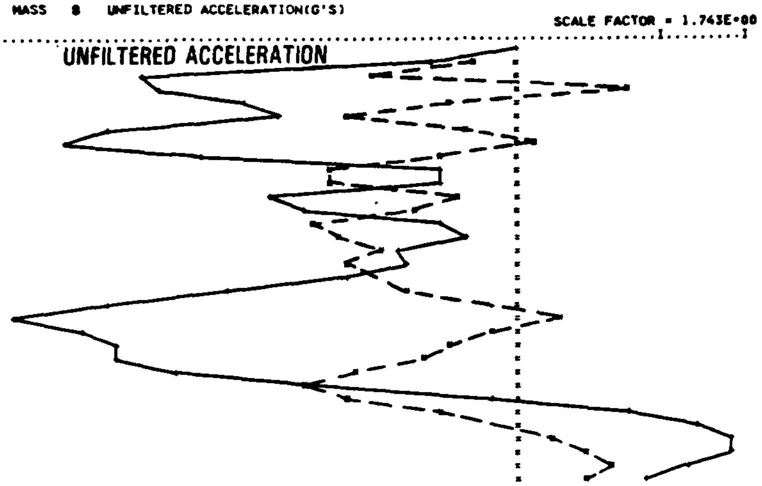
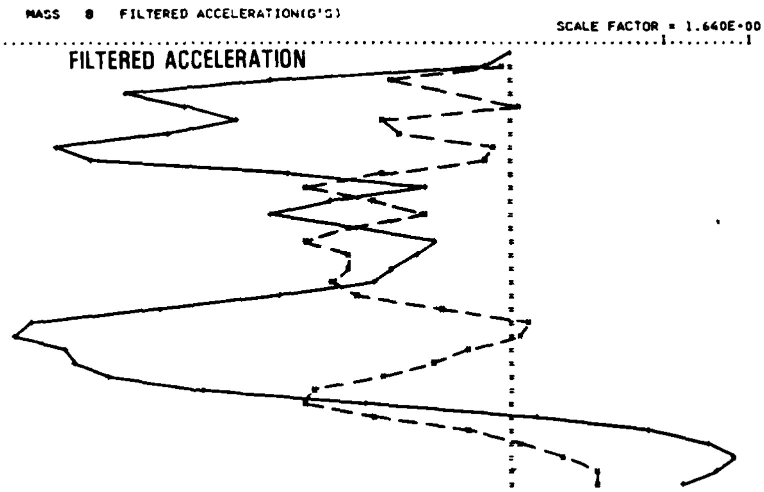


FIGURE 5-37. ACCELERATION RESPONSE AT FS1040, CONDITION NO. 3

TIME(SEC)	XACC *	YACC =	ZACC +
0.0	8.606E-03	0.0	-8.635E-03
0.005	-9.092E-01	0.0	-1.844E+00
0.010	-3.032E+00	0.0	-7.753E+00
0.015	2.184E+00	0.0	-7.442E+00
0.020	-1.508E+00	0.0	-5.590E+00
0.025	-3.593E+00	0.0	-4.846E+00
0.030	-1.033E+00	0.0	-8.398E+00
0.035	3.474E-01	0.0	-9.325E+00
0.040	-1.531E+00	0.0	-6.435E+00
0.045	-3.909E+00	0.0	-1.614E+00
0.050	-3.966E+00	0.0	-1.601E+00
0.055	-1.322E+00	0.0	-5.096E+00
0.060	-2.125E+00	0.0	-4.340E+00
0.065	-4.288E+00	0.0	-1.635E+00
0.070	-3.769E+00	0.0	-1.050E+00
0.075	-2.767E+00	0.0	-2.401E+00
0.080	-3.451E+00	0.0	-2.253E+00
0.085	-3.487E+00	0.0	-3.474E+00
0.090	-2.232E+00	0.0	-5.900E+00
0.095	-1.186E-01	0.0	-8.400E+00
0.100	7.964E-01	0.0	-1.033E+01
0.105	-5.320E-01	0.0	-9.000E+00
0.110	-1.461E+00	0.0	-8.198E+00
0.115	-1.889E+00	0.0	-8.294E+00
0.120	-3.320E+00	0.0	-7.004E+00
0.125	-4.411E+00	0.0	-4.263E+00
0.130	-3.558E+00	0.0	-6.220E-01
0.135	-1.537E+00	0.0	2.176E+00
0.140	2.584E-03	0.0	3.590E+00
0.145	7.080E-01	0.0	4.311E+00
0.150	1.330E+00	0.0	4.231E+00
0.155	1.819E+00	0.0	3.519E+00
0.160	1.322E+00	0.0	2.582E+00



TIME(SEC)	XACCF *	YACCF =	ZACCF +
0.0	0.0	0.0	0.0
0.005	-2.290E-01	0.0	-5.408E-01
0.010	-2.305E+00	0.0	-4.593E+00
0.015	-3.400E-02	0.0	-7.427E+00
0.020	1.880E-01	0.0	-6.301E+00
0.025	-2.546E+00	0.0	-5.289E+00
0.030	-2.231E+00	0.0	-6.529E+00
0.035	-3.546E-01	0.0	-8.741E+00
0.040	-6.192E-01	0.0	-8.055E+00
0.045	-2.559E+00	0.0	-4.264E+00
0.050	-3.927E+00	0.0	-1.701E+00
0.055	-2.598E+00	0.0	-3.506E+00
0.060	-1.708E+00	0.0	-4.641E+00
0.065	-3.240E+00	0.0	-3.047E+00
0.070	-3.989E+00	0.0	-1.485E+00
0.075	-3.201E+00	0.0	-1.801E+00
0.080	-3.159E+00	0.0	-2.290E+00
0.085	-3.501E+00	0.0	-2.668E+00
0.090	-2.939E+00	0.0	-4.550E+00
0.095	-1.344E+00	0.0	-6.798E+00
0.100	2.466E-01	0.0	-9.213E+00
0.105	8.818E-02	0.0	-9.560E+00
0.110	-9.476E-01	0.0	-8.582E+00
0.115	-1.525E+00	0.0	-8.375E+00
0.120	-2.473E+00	0.0	-7.772E+00
0.125	-3.784E+00	0.0	-5.891E+00
0.130	-3.981E+00	0.0	-2.802E+00
0.135	-2.657E+00	0.0	4.129E-01
0.140	-9.428E-01	0.0	2.571E+00
0.145	1.844E-01	0.0	3.774E+00
0.150	8.982E-01	0.0	4.217E+00
0.155	1.518E+00	0.0	3.892E+00
0.160	1.599E+00	0.0	3.152E+00



TIME(SEC)	XIMP *	YIMP =	ZIMP +
0.0	0.0	0.0	0.0
0.005	-2.021E-04	0.0	-5.9[illegible]E-04
0.010	-6.65[illegible]	0.0	-1.[illegible]E-02
0.015	[illegible]	0.0	-4.476E-02
0.020	[illegible]	0.0	-7.9[illegible]E-02
0.025	[illegible]	0.0	-1.06[illegible]E-01
0.030	[illegible]	0.0	-1.[illegible]E-01
0.035	[illegible]	0.0	[illegible]E-01
0.040	-3.8[illegible]	0.0	-2.[illegible]88E-01
0.045	-4.6[illegible]	0.0	-2.50[illegible]E-01
0.050	[illegible]	0.0	-2.631E-01
0.055	-8.[illegible]	0.0	-2.75[illegible]E-01
0.060	-9.[illegible]	0.0	-2.96[illegible]E-01
0.065	[illegible]	0.0	-3.167E-01
0.070	[illegible]	0.0	-3.27[illegible]E-01
0.075	[illegible]	[illegible]	-3.[illegible]E-01
0.080	[illegible]	[illegible]	-3.4[illegible]E-01
0.085	[illegible]	[illegible]	[illegible]
0.090	[illegible]	[illegible]	[illegible]
0.095	[illegible]	[illegible]	-4.[illegible]
0.100	[illegible]	[illegible]	-4.4[illegible]
0.105	[illegible]	[illegible]	-4.9[illegible]
0.110	[illegible]	[illegible]	-5.[illegible]
0.115	[illegible]	[illegible]	[illegible]
0.120	[illegible]	[illegible]	-6.[illegible]
0.125	[illegible]	[illegible]	-6.54[illegible]
0.130	[illegible]	[illegible]	-6.[illegible]E-01
0.135	[illegible]	[illegible]	-6.8[illegible]E-01
0.140	[illegible]	[illegible]	-6.[illegible]41E-01
0.145	[illegible]812E-0[illegible]	0.0	-6.578E-01
0.150	[illegible]	[illegible]	-6.[illegible]E-01
0.155	[illegible]	[illegible]	-6.[illegible]
0.160	-2.641E-0[illegible]	[illegible]	-5.99[illegible]E-01

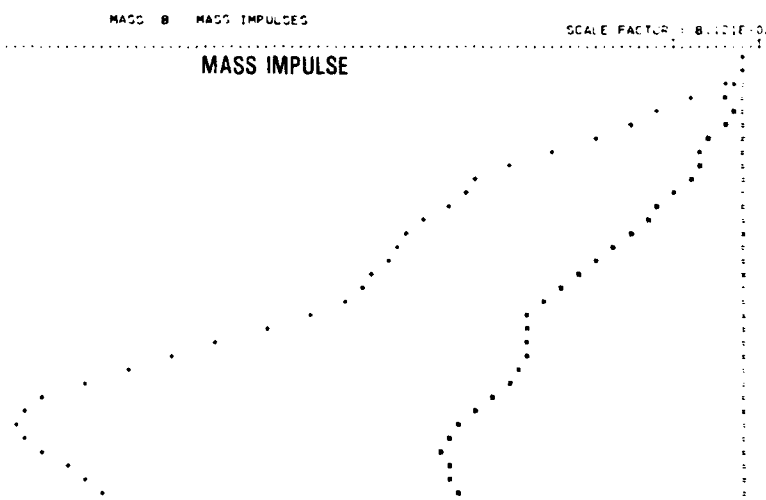
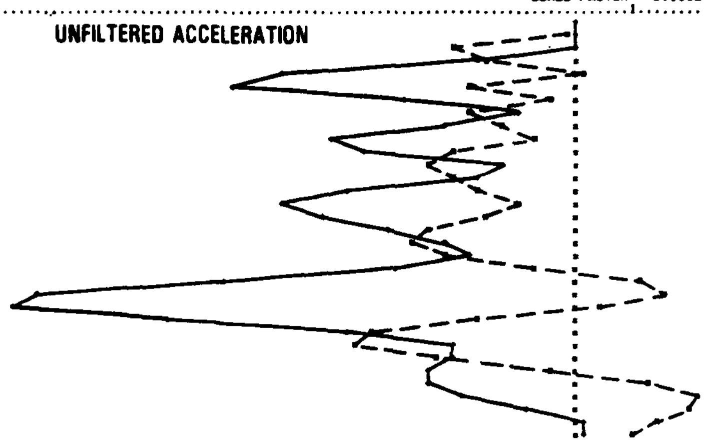


FIGURE 5-38. ACCELERATION RESPONSE AT FS1200, CONDITION NO. 3

MASS 9 UNFILTERED ACCELERATION(G'S)

SCALE FACTOR = 2.106E+00

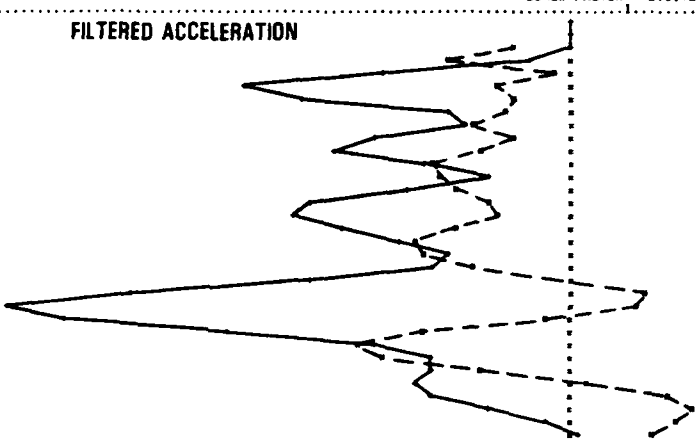
TIME(SEC)	XACC	YACC	ZACC
0.0	7.264E-03	0.0	2.242E-04
0.005	-1.739E-01	0.0	1.314E-02
0.010	-3.221E+00	0.0	-3.087E-03
0.015	-2.224E+00	0.0	-2.537E+00
0.020	1.572E-01	0.0	-7.574E+00
0.025	-2.791E+00	0.0	-8.913E+00
0.030	-6.708E-01	0.0	-4.478E+00
0.035	-2.647E+00	0.0	-1.492E+00
0.040	-1.940E+00	0.0	-3.439E+00
0.045	-1.115E+00	0.0	-6.365E+00
0.050	-3.229E+00	0.0	-5.443E+00
0.055	-3.708E+00	0.0	-1.768E+00
0.060	-3.189E+00	0.0	-2.389E+00
0.065	-2.467E+00	0.0	-5.877E+00
0.070	-1.391E+00	0.0	-7.534E+00
0.075	-2.247E+00	0.0	-6.427E+00
0.080	-3.775E+00	0.0	-4.804E+00
0.085	-4.106E+00	0.0	-3.263E+00
0.090	-3.222E+00	0.0	-2.612E+00
0.095	-1.108E+00	0.0	-4.689E+00
0.100	1.636E+00	0.0	-8.954E+00
0.105	2.402E+00	0.0	-1.389E+01
0.110	6.318E-01	0.0	-1.450E+01
0.115	-2.485E+00	0.0	-1.046E+01
0.120	-5.245E+00	0.0	-5.790E+00
0.125	-5.699E+00	0.0	-3.190E+00
0.130	-3.635E+00	0.0	-3.153E+00
0.135	-5.649E-01	0.0	-3.844E+00
0.140	2.006E+00	0.0	-3.822E+00
0.145	3.193E+00	0.0	-2.821E+00
0.150	3.002E+00	0.0	-1.125E+00
0.155	2.209E+00	0.0	2.559E-01
0.160	1.510E+00	0.0	2.673E-01



MASS 9 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 2.019E+00

TIME(SEC)	XACCF	YACCF	ZACCF
0.0	0.0	0.0	0.0
0.005	-3.240E-02	0.0	2.034E-03
0.010	-1.429E+00	0.0	4.660E-02
0.015	-3.055E+00	0.0	-9.880E-01
0.020	-5.405E-01	0.0	-4.742E+00
0.025	-1.775E+00	0.0	-8.066E+00
0.030	-1.469E+00	0.0	-6.731E+00
0.035	-1.679E+00	0.0	-3.125E+00
0.040	-2.385E+00	0.0	-2.586E+00
0.045	-1.362E+00	0.0	-4.810E+00
0.050	-2.201E+00	0.0	-5.918E+00
0.055	-3.402E+00	0.0	-3.626E+00
0.060	-3.369E+00	0.0	-2.115E+00
0.065	-2.935E+00	0.0	-4.080E+00
0.070	-1.958E+00	0.0	-6.504E+00
0.075	-1.808E+00	0.0	-6.901E+00
0.080	-2.962E+00	0.0	-5.682E+00
0.085	-3.851E+00	0.0	-4.244E+00
0.090	-3.738E+00	0.0	-2.985E+00
0.095	-2.406E+00	0.0	-3.566E+00
0.100	3.667E-02	0.0	-6.437E+00
0.105	1.862E+00	0.0	-1.099E+01
0.110	1.539E+00	0.0	-1.397E+01
0.115	-6.870E-01	0.0	-1.255E+01
0.120	-3.575E+00	0.0	-8.510E+00
0.125	-5.305E+00	0.0	-4.885E+00
0.130	-4.711E+00	0.0	-3.410E+00
0.135	-2.344E+00	0.0	-3.569E+00
0.140	4.091E-01	0.0	-3.838E+00
0.145	2.362E+00	0.0	-3.388E+00
0.150	2.992E+00	0.0	-2.117E+00
0.155	2.616E+00	0.0	-5.822E-01
0.160	1.934E+00	0.0	1.857E-01



MASS 9 MASS IMPULSES

SCALE FACTOR = 8.977E-02

TIME(SEC)	XIMP	YIMP	ZIMP
0.0	0.0	0.0	0.0
0.005	-1.246E-05	0.0	1.415E-06
0.010	[illegible]	0.0	1.414E-04
0.015	[illegible]	0.0	-1.278E-02
0.020	[illegible]	0.0	-2.497E-02
0.025	[illegible]	0.0	-4.853E-02
0.030	[illegible]	0.0	-8.754E-02
0.035	[illegible]	0.0	-1.115E-01
0.040	[illegible]	0.0	-1.241E-01
0.045	-6.548E-02	0.0	-1.422E-01
0.050	[illegible]	0.0	-1.705E-01
0.055	[illegible]	0.0	-1.952E-01
0.060	[illegible]	0.0	-2.079E-01
0.065	[illegible]	0.0	-2.226E-01
0.070	[illegible]	0.0	-2.497E-01
0.075	[illegible]	0.0	-2.842E-01
0.080	[illegible]	0.0	-3.159E-01
0.085	[illegible]	0.0	-3.407E-01
0.090	[illegible]	0.0	-3.562E-01
0.095	[illegible]	0.0	-3.727E-01
0.100	[illegible]	0.0	-3.980E-01
0.105	[illegible]	0.0	-4.416E-01
0.110	[illegible]	0.0	-5.058E-01
0.115	[illegible]	0.0	-5.727E-01
0.120	[illegible]	0.0	-6.269E-01
0.125	[illegible]	0.0	-6.591E-01
0.130	[illegible]	0.0	-6.787E-01
0.135	[illegible]	0.0	-6.958E-01
0.140	[illegible]	0.0	[illegible]
0.145	[illegible]	0.0	-7.330E-01
0.150	[illegible]	0.0	-7.469E-01
0.155	[illegible]	0.0	-7.525E-01
0.160	-2.306E-01	0.0	-7.539E-01

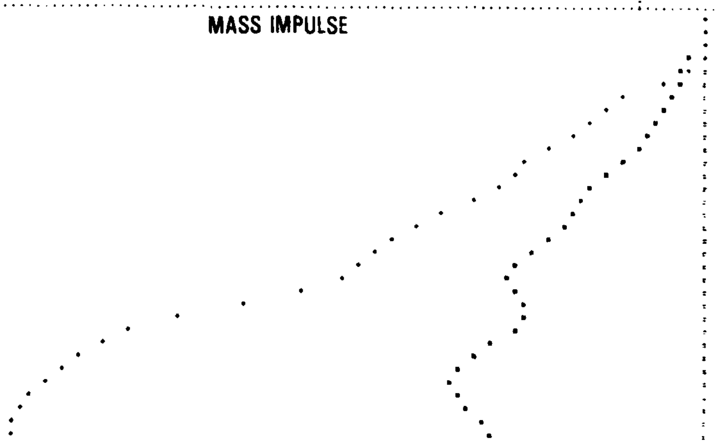


FIGURE 5-39. ACCELERATION RESPONSE AT FS1400, CONDITION NO. 3

SECTION 6

CID PRE-TEST ANALYSIS

6.1 KRASH MODEL

The expanded KRASH model for the CID test, shown in figure 6-1, is a symmetrical half-airplane representation consisting of 48 masses and 137 beam elements. The overall weight, c.g., and stiffnesses are compared with similar characteristics for the 19 mass 18 beam stick model (figure 4-2). The initial static deflections were obtained using the IC coding (via NASTRAN) for both the stick and expanded models. A comparison of these results is shown in table 6-1. The expanded model shows approximately 2.4 inches more deflection at the extreme forward fuselage station as compared to the stick model which is attributed to differences in stiffness and/or initial loading between the two models. At the wing and aft fuselage locations the initial static deflections for both the stick and expanded models are in good agreement. Subsequent expanded model changes to improve the fuselage stiffness representation and wing representation shows better agreement with regard to static deflections (<1.0 inch difference), as noted in parentheses in Table 6-1. Since these changes were incorporated after the study was concluded, the analysis results described in this section are based on the more flexible model. A comparison of model parameters for the stick and expanded models is shown in figure 6-2. The models show good agreement with regard to weight, cg, mass inertia and overall vehicle forces. The overall vehicle forces and accelerations show the six net loads at the airplane c.g., and the resulting six rigid body accelerations. In KRASH these c.g. accelerations are used to calculate the rigid body accelerations at each mass point in the model. These mass point accelerations yield inertia relief loads at each mass point. When these inertia relief loads are calculated in KRASH and included in the total airplane force moment balance, the net c.g. loads and accelerations should ideally be zero. For both models they are

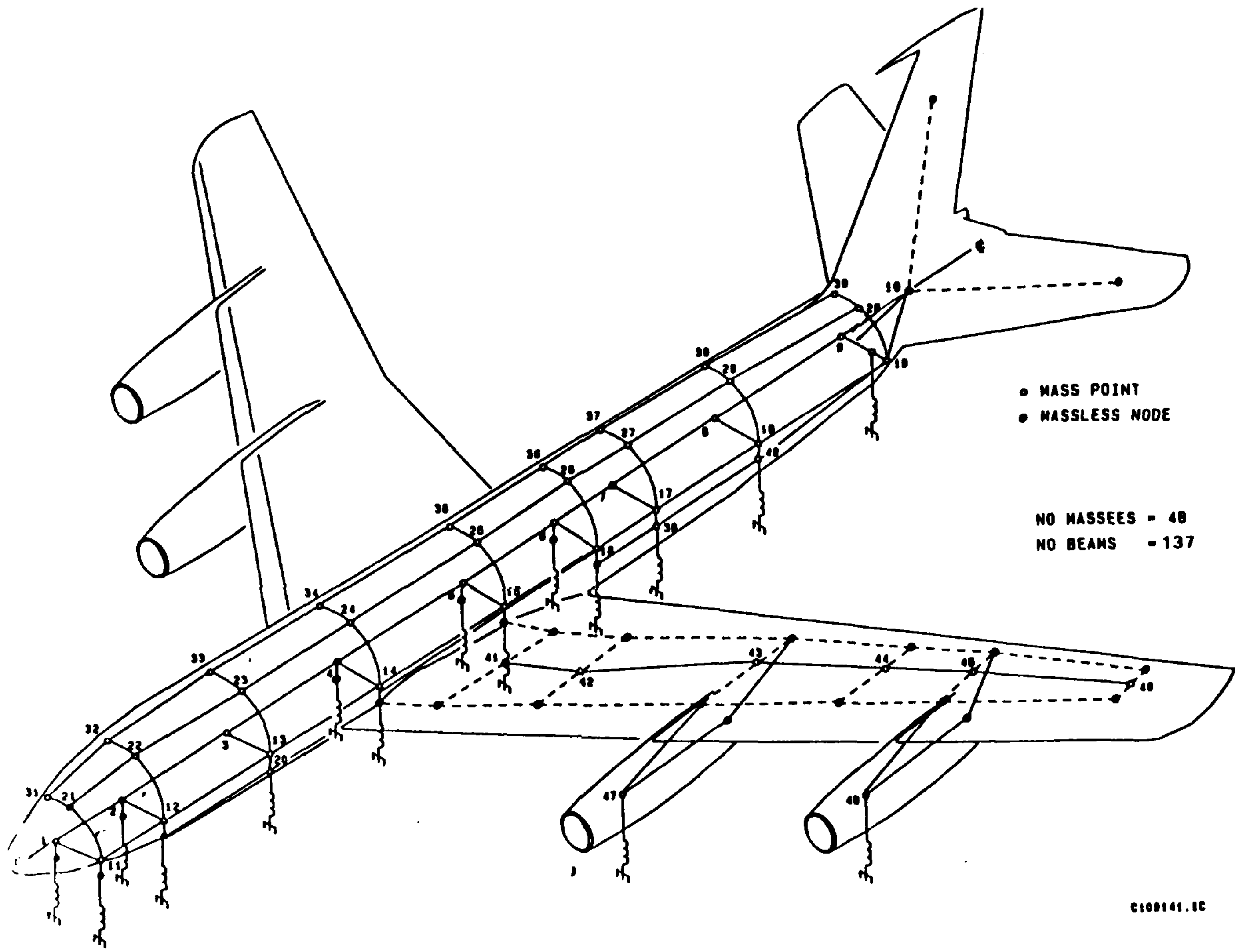


FIGURE 6-1. EXPANDED CID KRASH MODEL

TABLE 6-1. STATIC DEFLECTIONS

LOCATION	DEFLECTION, in. STICK MODEL FIG. 4-1	CID MODEL FIG. 6-1	DIFFERENCE IN inches
FUSELAGE			
FS 199	-1.07	-3.42 (-1.90)	2.35 (0.83)
FS 300	-0.83	-2.99 (-1.71)	2.09 (0.88)
FS 460	-0.45	-2.25 (-1.35)	1.80 (0.90)
FS 620	-0.16	-1.32 (-0.80)	1.16 (0.64)
FS 820	0	0 (0)	0 (0)
FS 960	-0.21	-0.03 (-0.09)	0.18 (0.12)
FS 1040	-0.49	-0.16 (-0.23)	0.33 (0.26)
FS 1200	-1.25	-0.94 (-0.99)	0.31 (0.26)
FS 1400	-2.65	-2.54 (-2.57)	0.11 (0.08)
FS 1570	-4.07	-4.03 (-4.10)	0.04 (0.03)
WING			
Root	+0.81	+0.61 (+0.63)	0.20 (0.18)
Tip	+40.5	+41.2 (+39.9)	0.70 (0.60)

\+ upward displacement
\- downward displacement

(XXX) REVISED MODEL RESULTS

extremely small, which is satisfactory. The analyis results using the KRASH stick model have been presented in Section 5.0. The pre-CID analysis results using the expanded KRASH model are described in this section. The variations in allowing failure as opposed to yielding that were investigated using the expanded model are summarized in the following table:

Condition	Number of Masses	Number of Beams	Number of Nonlinear Beams	Aerodynamic Loading
1	48	137	44	Yes
2	48	137	19	Yes
3	48	137	19	No

(A) Stick

```
MODEL PARAMETERS

VEHICLE WT = 1.924740D 05

VEHICLE CG POSITION
X (FS) =  8.44728D 02
Y (BL) =  0.0
Z (WL) =  2.18312D 02

VEHICLE INERTIAS (IN-LB-SEC**2)
I(XX) =  3.54622D 07
I(YY) =  3.92783D 07
I(ZZ) =  7.32031D 07
I(XY) =  0.0
I(YZ) =  0.0
I(XZ) =  2.31423D 06

VEHICLE CG INITIAL GROUND COORDINATES
XCG IS THE DISTANCE FROM SLOPE/GROUND INTERSECTION TO VEHICLE CG,+FORWARD
ZCG IS THE DISTANCE FROM GROUND PLANE TO VEHICLE CG,+DOWN
XCG =  0.0
ZCG = -8.55505D 01

OVERALL VEHICLE FORCES AND ACCELS(G-S), A/P AXES

  FX=    1.66961D 03    AX=    8.67446D-03
  FY=    0.0            AY=    0.0
  FZ=   -5.17204D 03    AZ=   -2.68714D-02
  MX=    0.0           PDT=    0.0
  MY=    7.50458D 05   QDT=    1.91062D-02
  MZ=    0.0           RDT=    0.0

OVERALL VEHICLE FORCES AND ACCELS(G-S), INCLUDING INERTIA RELIEF, A/P AXES

  FX=    4.12115D-13    AX=    2.14115D-18
  FY=    0.0            AY=    0.0
  FZ=    1.09139D-11    AZ=    5.67034D-17
  MX=    0.0           PDT=    0.0
  MY=    4.94765D-10   QDT=    1.25964D-17
  MZ=    0.0           RDT=    0.0
```

(B) Expanded

```
MODEL PARAMETERS

VEHICLE WT = 1.924746D+05

VEHICLE CG POSITION
X (FS) =  8.44131D+02
Y (BL) =  0.0
Z (WL) =  2.13005D+02

VEHICLE INERTIAS (IN-LB-SEC**2)
I(XX) =  3.43332D+07
I(YY) =  3.82381D+07
I(ZZ) =  7.17985D+07
I(XY) =  0.0
I(YZ) =  0.0
I(XZ) =  1.67203D+06

VEHICLE CG INITIAL GROUND COORDINATES
XCG IS THE DISTANCE FROM SLOPE/GROUND INTERSECTION TO VEHICLE CG,+FORWARD
ZCG IS THE DISTANCE FROM GROUND PLANE TO VEHICLE CG,+DOWN
XCG =  0.0
ZCG = -7.94658D+01

OVERALL VEHICLE FORCES AND ACCELS(G-S), A/P AXES

  FX=    2.51821D+03    AX=    1.30833D-02
  FY=    0.0            AY=    0.0
  FZ=   -5.07993D+03    AZ=   -2.63927D-02
  MX=    0.0           PDT=    0.0
  MY=    2.42083D+05   QDT=    6.33095D-03
  MZ=    0.0           RDT=    0.0

OVERALL VEHICLE FORCES AND ACCELS(G-S), INCLUDING INERTIA RELIEF, A/P AXES

  FX=    1.76215D-12    AX=    9.15521D-18
  FY=    0.0            AY=    0.0
  FZ=    1.36424D-11    AZ=    7.08791D-17
  MX=    0.0           PDT=    0.0
  MY=    1.33878D-09   QDT=    3.50116D-17
  MZ=    0.0           RDT=    0.0
```

FIGURE 6-2. KRASH MODELS PARAMETERS

The echo of input data for the CID model is provided in Appendix Section A-4 for condition 1 which considers an initial aerodynamic lift distribution.

The load interaction curves described in Section 5.3 were used to compare static (time = 0) internal beam loading for both the stick and expanded model. These results are presented in table 6-2. With the exception of the ratios at the wing leading (FS 620) and trailing edge (FS 820) attachments to the fuselage, all the ratios are in excellent agreement. As in the comparison of static deflections the subsequent revised expanded, not used in the analysis, showed some improvement as noted by the numbers in parentheses in Table 6-2. The major contributor to the LIC ratio difference is the manner in which the wing attaches to the fuselage for each model. In the stick model, one beam connects the wing root to the fuselage centerline. In the expanded model, the wing root is represented as a box beam which connects at two locations to the fuselage at FS 620 and with two more beams at FS 820. The effect of these modeling differences will be pursued in the post-CID analyses.

The stick and expanded models also show comparable pertinent wing and fuselage fundamental frequencies and mode shapes, which are also in agreement with published airplane data (Reference 16). A summary of pertinent free-free modal frequencies is noted in the following table.

Mode	Frequency, Hz		
	Stick Model	Expanded Model	Reference (16) Data
Wing vertical bending	1.03	1.04	1.09
Fuselage vertical bending	3.37	3.29	3.19 - 3.40

Each Model contains the same mass and beam designations, but differ either in external force loading or treatment of post-failure loads. Each of the analyses was performed to a simulated .160 second impact, which encompasses the time for peak responses to occur. A description of the masses and beams for

TABLE 6-2. COMPARISON OF BEAM INITIAL LIC RATIOS

CURVE NO.	FUSELAGE STATION	LOAD INTERACTION CURVE RATIO	
		STICK MODEL	EXPANDED MODEL
1	300	0.011	0.009 (0.009)
2	350	0.061	0.062 (0.062)
3	450	0.058	0.052 (0.052)
4	480	0.122	0.120 (0.118)
5	540	0.122	0.120 (0.118)
6	600	0.124	0.121 (0.121)
7	620	0.151	0.258 (0.233)
8	820	0.209	0.360 (0.326)
9	820	0.426	0.431 (0.429)
10	960	0.203	0.205 (0.204)
11	960	0.203	0.205 (0.204)
12	1000	0.249	0.251 (0.250)
13	1080	0.245	0.248 (0.247)
14	1160	0.273	0.276 (0.275)
15	1240	0.190	0.192 (0.191)
16	1320	0.158	0.163 (0.162)
17	1400	0.199	0.203 (0.202)
18	1400	0.177	0.181 (0.181)
( )REVISED MODEL RESULTS			

the CID models is shown in tables 6-3 and 6-4, respectively. The diagonal beams (beam numbers 90-137) are tension only members to account for shear loads between frames and m bulkheads.

TABLE 6-3. CID MODEL MASS DESCRIPTION

MASS NO.	REPRESENTATION
1 - 19, 20, 30, 40	Floor, occupant and lower fuselage
21 - 29, 31 - 39	Upper Fuselage shell and cabin
41 - 46	Wing
47, 48	Inboard, outboard engines

TABLE 6-4. CID MODEL BEAM DESCRIPTIONS

BEAM NO.	BEAM CONNECTIVITY	REPRESENTATION
1-9	1-11, 2-12, . . . , 9-19	Floor transverse beams
10-27	11-21, . . . , 19-29, 21-31, . . . , 29-39	Upper shell frames
28, 29, 30	13-20, 17-30, 18-40	Lower shell vertical beams
31-38	21-22, . . ., 28-29	Upper shell longitudinal beams
39-46	31-32, . . ., 38-39	Upper shell longitudinal beams
47-54	1-2, . . ., 8-9	Inboard floor longitudinal beams
55-62	11-12, . . . 18-19	Outboard floor longitudinal beams
63	9-10	Horizontal stabilizer - cabin
64-68	12-20, . . ., 19-40	Lower fuselage longitudinal beams
69, 70	43^2-47^1, 45^2-48^1	Inboard, outboard engine rear attach points
71-74	15-41^1, 14-42^2, 41^3-0, 41^4-0	Wing root attachments to fuselage
75, 76	43^1-47, 45^1-48	Inboard, outboard engine forward attach points
77-81	41-42, . . ., 45-46	Wing inboard to outboard members
82-89	1^2-2^3, 2^3-3^1, 3^1-4^1, . . ., 8^1-9^1	Lower fuselage longitudinal members
90-93	2-12^1, 4-14^1, 5-15^1, 6-16^1	Bulkhead diagonals
94, 95	16^1-17, 16-30	FS 960-1040 lower diagonals
96, 97	17-40^1, 18-30	FS 1040-1200 lower diagonals
98, 99	12-20^1, 12^1-13	FS 300-460 lower diagonals
100, 101	14-20^1, 14^1-13	FS 460-620 lower diagonals
102-115	12-23, . . . , 18-29, 13-22, . . . , 19-28	FS 300-1400, upper diagonals, WL 205-270
116-129	22-33, . . . , 28-39, 23-32, . . . , 29-38	FS 300-1400, upper diagonals WL 270-293
130-137	5^1-15, . . ., 2^3-12	FS 300, 620, 820 and 960 Bulkhead shear web diagonals
Prime designates Massless node.		

6.2 KRASH ANALYSIS RESULTS

The analytical results based on the three cases noted in Section 6.1 are summarized in tables 6-5 through 6-10. Table 6-5 shows the amount of crush between FS300 to FS1200. For the most part the large deformation at FS300 is accompanied by an extremely low load level, as can be observed from the external spring description provided in figure 5-26. The amount of deflection noted in the forward fuselage may be exaggerated since the expanded model appears to be more flexible in that region (table 6-1). The impact sequence is shown in table 6-6. There are variations in impact sequence between the three cases as might be expected. Contact all along the fuselage occurs within the 60 milliseconds after impact. Peak deflections occur at all locations within 160 msec. after impact. Table 6-7 shows the yield and rupture sequence for the analytical cases that were run. The yield and rupture values used were those calculated in program KRASH for the respective beams, based on beam and material properties. The values are printed in the section of the output denoted "Model Parameter Data". For all the nonlinear beams a yield type 5 (load remains constant after a yield deflection is reached) was used. Each of the cases run contained 33 force rupture cutoff values. Case Number 1 contains 44 nonlinear beams. The "rupture allowable" cases (No's 2 and 3) contain 19 nonlinear beams, thus allowing for a rupture rather than a yield to occur for selected beams. Table 6-8 presents the beam deflections for the three cases analyzed. The three cases show a lateral deflection of up to 4.0 inches for the upper shell above the floor at FS960. This can be interpreted potentially as a bulge in that area. A floor maximum vertical deflection of 5.9 inches is noted in the FS620-820 region.

Table 6-9 shows the vertical acceleration values obtained from the analysis. Both the plotted peak and the equivalent triangular pulse peak values are noted in Table 6-9. The manner in which the equivalent triangular pulse is obtained and the reasons for showing it have been described in

TABLE 6-5. ANALYSIS RESULTS, FUSELAGE CRUSH

FUSELAGE STATION	MASS NUMBER	PEAK DEFLECTION, in.		
		1	2	3
300	2,12	7.8,7.6	9.4, 9.6	9.7,9.8
460	20	5.0	6.9	7.5
620	4,14	4.8,5.1	5.7,6.0	6.2,7.1
820	5,15	7.7, 8.2	7.3,8.0	10.2,11.0
960	6,16	9.0,9.8	6.0, 8.1	12.2, 12.6
1040	30	9.1	7.5	11.8
1200	40	3.4	4.1	4.9
* INCREASING AT FINAL TIME OF ANALYSIS				

Section 5. The higher peak values are associated with relatively short pulse durations as can be observed in the data presented in figure 6-3. The peak values tend to be higher than the values associated with an equivalent triangular pulse.

Program KRASH has provisions for printing and plotting mass axis component forces for selected beams. It also has provisions for internally summing up forces and moments at a particular station. Using this feature the mass axis component forces were determined for the condition 1 analysis. Table 6-10 summarizes the peak shear, moment and LIC ratios along the fuselage for condition 1. The input shear-moment envelope, representing the capability of the region of overall fuselage section, is not exceeded. At and aft of the MLG bulkhead the LIC ratios reach .820 (approximately 18% margin). The maximum shear and moment values obtained in the expanded model are 205,000 lb. and 55.2 x 10^6 in-lb., respectively. The stick model showed both higher peak shear (225,000 lb) and higher peak moments (75 x 10^6 in-lb.) in the region between FS960-1000. Whether these differences are attributable to the manner in which structure is detailed or to differences in responses associated with more detail or some combination of both can only be determined when the test results are evaluated. The analysis results presented herein indicate that a CID test impacting at the conditions noted will most likely experience accelerations and structural damage similar to that sustained by the B707 airplane tested at Laurinburg, N.C. and described in Section 5. The results of the expanded model incorporating structural response information from the B707 airplane drop indicate that the results of the CID

TABLE 6-6. IMPACT SEQUENCE

CASE	INITIAL CONTACT TIME, MSEC$^{(1)}$	PEAK DEFLECTION OCCURS TIME, MSEC$^{(1)}$
No. 1		
Aft fuselage sta. 960	0	112.8$^{(2)}$, 105.1$^{(3)}$
MLG bulkhead, sta. 1040	4.3	108.1
Inboard engine	9.0	86.4
Wing center section T.E., sta. 820	10.6	100.9$^{(2)}$, 97.6$^{(3)}$
Wing center section L.E., sta. 620	27.7	90.5$^{(2)}$, 93.9$^{(3)}$
Forward fuselage sta. 460	36.5	114.1
NLG bulkhead sta. 300	40.7	105.3$^{(2)}$, 11 1.5$^{(3)}$
Aft fuselage, sta. 1200	50.	108.
No. 2		
Aft fuselage sta. 960	0	76.7
MLG bulkhead sta. 1040	4.3	51.4$^{(2)}$, 70.9$^{(3)}$
Inboard engine	9.0	85.8
Wing center section T.E., sta. 820	10.6	87.2$^{(2)}$, 87$^{(3)}$
Wing center section L.E. sta. 620	27.0	98.7$^{(2)}$, 102.3$^{(3)}$
Forward fuselage, sta. 460	36.5	127
NLG bulkhead, sta. 300	40.7	123.4$^{(2)}$, 124$^{(3)}$
Aft fuselage sta. 1200	50.0	160.
No. 3		
Inboard engine	0	77
Fuselage sta. 960	3.6	124.7$^{(2)}$, 117.4$^{(3)}$
MLG bulkhead sta. 1040	8.6	123.1
Wing center section T.E., sta. 820	13.9	108.5$^{(2)}$, 109.3$^{(3)}$
Wing center section L.E., sta. 620	35.8	107.7$^{(2)}$, 116.5$^{(3)}$
Forward fuselage sta. 460	47.9	136.5
NLG bulkhead sta. 300	54.5	155.1$^{(2)}$, 150.6$^{(3)}$
Outbd engine	114.8	–
NLG bulkhead sta. 199	114.9	147.9
Aft fuselage sta. 1200	55.3	141.

(1) Time after impact

(2) Inboard location

(3) Outboard location

TABLE 6-7. ANALYSIS RESULTS, YIELD/RUPTURE SEQUENCE

TIME AFTER IMPACT sec	CONDITION		
	1	2	3
0-0.015	16^1-30 Y	16^1-30 Y	43^1-47 R
0.015-0.030	43^1-47 R	43^1-47 R	
0.030-0.045	5^1-6^1 Y	6^1-7^1 R	
0.045-0.060	7^1-8^1 Y	30-40 Y 16-17 R	
0.060-0.075 14	19-40 Y 14^1-20 Y 4^1-5^1 Y	6-7 R 14^1-20 R	43^2-47^1 R
0.075-0.090			14^1-20 Y
0.090-0.120	8^1-9^1 Y 13-14 Y 3^1-4^1 Y 3-4 Y		13-14 R 4^1-5^1 R 5-15 R 14-41^1 R 15-41^2 R 14-15 R 4-5 R
0.120-0.150			45^1-48 R 45^2-48^1 R

Y – YIELD
R – RUPTURE
SUPERSCRIPT DENOTES NODE POINT DESIGNATION

TABLE 6-8. ANALYSIS RESULTS, BEAM DEFLECTIONS

LOCATION DIRECTION	BEAM NO.	$MASS_i$-$MASS_j$	DEFLECTIONS, in. CONDITIONS		
			1	2	3
Floor-Vertical	49	3-4	2.46	1.71	2.1
	50	4-5	2.36	1.81	5.9 R
	51	5-6	0.37	0.86	0.78
	52	6-7	0.32	3.1 R	0.33
	53	7-8	2.1	1.81	1.7
	57	13-14	0.69	1.44	0.83 R
	58	14-15	0.54	0.5	2.18 R
	59	15-16	0.95	0.98	0.91
	60	16-17	0.83	0.88 R	0.62
Upper Shell - Lateral	20	16-26	1.22	4.0	1.74
	21	26-36	1.17	1.7*	0.66
Floor transverse - Vertical	4	4-14	0.61	0.64	1.27
	5	5-15	1.05	0.84	1.6 R
	6	6-16	1.1	3.0	1.42
Cabin longerons - Vertical	33	23-24	0.67	0.93	1.06
	34	24-25	0.64	0.73	2.87
	35	25-26	0.56	0.78	0.58
	36	26-27	0.26	1.16	0.18
	37	27-28	1.34	2.7*	1.02
	41	33-34	0.52	0.34	0.69*
	42	34-35	0.81	0.76	1.9*
	43	35-36	0.40	1.04*	0.69*
	44	36-37	0.15	0.55	0.14
	45	37-38	0.62	1.69	0.36

* Increasing at end of analysis
R Beam rupture occurred

test will not be as damaging to the aircraft as noted in the pretest analysis presented in Section 4.

Subsequent to the analysis for the cases described in Section 6.1 a KRASH model was run in which all diagonal tension members representing fuselage shear webs were removed. This resulted in a 48 mass 101 beam representation. A comparison of peak accelerations and fuselage crushing and beam deflections are shown in tables 6-11, 6-12 and 6-13 respectively. The results are comparable because either 1) the beam properties selected didn't influence the response or 2) the shear loads do not significantly influence the overall airplane response. Unless

TABLE 6-9. ANALYSIS RESULTS, PEAK VERTICAL ACCELERATIONS

FUSELAGE STATION	MASS NO.	VERTICAL, g. [1] [2] [3] 1	2	3
300	2, 12	26.0 (16), 17.2 (15.2)	21.2 (12.6), 13.4 (12.4)	24 (11.4), 15.7 (11.4)
460	3, 13	16.4 (12), 18.1 (13)	15.8 (10.6), 17.5 (12.0)	14.5 (13.9), 16.1 (14.0)
620	4, 14	17.8 (12), 13.1 (11.8)	17.9 (12.6), 13.1 (11.8)	18.2 (14.4), 12.4 (11.6)
820	5, 15	12.0 (10.6), 8.2 (9.4)	12.1 (11.2), 10.0 (9.5)	12.2 (12.9), 19.4 (13.0)
960	6, 16	14.7 (8.8), 11.2 (9.2)	29.4 (11.6), 14.6 (11.6)	16.2 (10.6), 14.0 (8.5)
1040	7, 17	16.7 (9.2), 17.3 (9.4)	16.7 (11.6), 17.3 (10.4)	17.0 (13.0), 13.1 (8.5)
1200	8, 18	11.4 (10.2, 11.5 (8.8)	11.5 (8.6), 12.6 (9.7)	9.8 (9.3), 8.9 (8.2)

[1] 50 Hz Filter

[2] Upward Diraction

[3] A(B); A = plotted peak acceleration, (B) Equivalent Triangular Pulse = $\frac{\text{IMPULSE} \times 2}{\Delta t}$

Table 6-10. SUMMARY OF FUSELAGE PEAK SHEAR AND MOMENT LOADS AND LIC RATIOS

CURVE NUMBER	FUSELAGE STATION	MAXIMUM SHEAR X E4	MAXIMUM MOMENT X E6	MAXIMUM LIC RATIO
1	300	3.5	3.7	0.248***
2	350	14.3	13.5	0.864***
3	450	14.4	18.0	0.760***
4	480	9.2	31.0	0.620*
5	540	9.3	34.1	0.684*
6	600	9.3	37.3	0.60*
7	620	9.5	39.2	0.63*
8/9	820	8.3	42.2	0.68*
10/11	960	20.5	55.2	0.65**
12	990	20.5	52.1	0.82**
13	1080	16.7	41.2	0.82**
14	1160	16.7	32.9	0.80*
15	1210	11.5	28.8	0.58*
16	1320	11.5	19.1	0.64**
17/18	1400	11.5	13.2	0.81**

*Maximum Load Ratio Associated with Occurrence of Peak Moment

**Maximum Load Ratio Associated with Occurrence of Peak Shear

***Maximum Load Ratio Associated With Occurrence of Peak Shear and Peak Moment

TABLE 6-11. COMPARISON OF PEAK ACCELERATION WITH AND WITHOUT FUSELAGE SHELL SHEAR REPRESENTATION

MASS NO.	NO FUSELAGE SHELL SHEAR*	FUSELAGE SHELL SHEAR*
3,13	16.9 (12.0), 20.5 (13.2)	14.5 (13.9), 16.1 (14)
4,14	18.2 (14.0), 12.9 (12.2)	19.2 (14.4), 12.4 (11.6)
5,15	12.2 (11.5), 8.5 (11.0)	12.2 (12.9), 19.4 (13.0)
6,16	33.6 (11.0), 14.8 (11.5)	10.2 (10.6), 14.0 (8.5)
7,17	17.7 (10.0), 18.3 (11.0)	17.0 (13.0), 13.1 (8.5)
8,18	10.7 (8.2), 13.6 (9.6)	19.8 (9.3), 8.9 (8.2)

*Peak acceleration, g (pulse durations are short .03 to .06 seconds), based on 50 Hz filter
( ) Equivalent triangular pulse = $\frac{\text{Impulse x2}}{\Delta T}$

TABLE 6-12. COMPARISON OF PEAK CRUSHING WITH AND WITHOUT FUSELAGE SHELL SHEAR REPRESENTATION

MASS NO. INBD/OUTBD	NO FUSELAGE SHELL SHEAR*	FUSELAGE SHELL SHEAR*
2/12	9.9/9.9	9.4/9.6
20	6.0	6.9
4/14	5.2/5.2	5.7/6.0
5/15	7.2/7.7	7.3/8.0
6/16	6.2/8.4	6.0/8.1
30	7.6	7.5
40	3.9	4.1

*Crushing distance, inches

the test results prove otherwise, the model might be simplified by eliminating some beam members. The fuselage region below the passenger floor is most likely in compression in which case diagonal tension members in this region are not functional. Thus if diagonal tension members will be needed to better represent fuselage web shear the upper fuselage shell would be the preferred locations.

TABLE 6-13. COMPARISON OF BEAM DEFLECTIONS FOR MODELING WITH AND WITHOUT FUSELAGE SHELL SHEAR REPRESENTATION

LOCATION DIRECTION	BEAM NO.	$MASS_i$-$MASS_j$	DEFLECTIONS, in. CONDITIONS	
			(a)	(b)
Floor-Vertical	49	3-4	1.71	2.3
	50	4-5	1.81	2.2
	51	5-6	0.86	0.78
	52	6-7	3.1 R	5.5 R
	53	7-8	1.81	2.9
	57	13-14	1.44	1.0 R
	58	14-15	0.50	0.73
	59	15-16	0.98	1.08
	60	16-17	0.88 R	1.2 R
Upper Shell - Lateral	20	16-26	4.0	3.6
	21	26-36	1.7*	1.4
Floor transverse - Vertical	4	4-14	0.64	0.59
	5	5-15	0.84	0.91
	6	6-16	3.0	3.0
Cabin longerons - Vertical	33	23-24	0.93	1.17
	34	24-25	0.73	0.75
	35	25-26	0.78	0.79
	36	26-27	1.16	1.04
	37	27-28	2.7*	2.3*
	41	33-34	0.34	0.66
	42	34-35	0.76	0.96
	43	35-36	1.04*	0.88
	44	36-37	0.55	0.55*
	45	37-38	1.69	1.98*

* Increasing at end of analysis
R Beam rupture occurred

(a) Fuselage shell shear
(b) No fuselage shell shear

6.3 SUMMARY OF CID PRE-TEST ANALYSIS RESULTS

The aft fuselage (FS960 and aft) could crush from 6 to 12 inches. The wing center section may experience 5 to 8 inches of crush. The midforward fuselage (FS460) shows 5 to 7 inches of crush. The fuselage underside adjacent to the nose gear aft bulkhead at FS300 shows nearly 10 inches of deflection. However, this value may be misleading because 1) the load-deflection curve allows deflection to occur with little accompanying load after about 2 inches, and 2) the flexibility of the model may contribute some additional deflection in the extreme forward region.

Table 6-14 shows a range of deflections for beams. Floor peak vertical deflection of up to 6 inches occurs along the centerline. Along the outboard region of the floor deflections range up to 2 inches. Transverse floor beam vertical displacements of up to 3.0 inches occur at stations between FS620 and FS960. These peak deflections occur for a condition in which rupture occurs. Lateral displacement of the upper cabin fuselage structure at around station 960 is between 1.4 and 3.6 inches.

The CID pre-test analysis was performed using the two models described: a stick model consisting of 17 masses and 16 beam elements (figure 4-2), and an expanded model consisting of 48 masses and 137 beam elements (figure 6-1). The stick model due to its coarseness tends to provide lower frequency acceleration responses than the finer expanded model. It is not uncommon to see substantially higher peak acceleration responses obtained from the expanded model than from the stick model. However, the higher peaks are generally associated with shorter duration pulses than the lower peaks. The triangular pulse shape equivalent responses obtained from the analysis are plotted in figure 6-3. Also shown in figure 6-3 is a curve depicting a constant ΔV

TABLE 6-14. SUMMARY OF BEAM PEAK DEFLECTION RANGE

DESCRIPTION	LOCATION	DEFLECTION, inches
Upper Shell Lateral	station 960 WL 205-271	1.22 to 4.0
Upper Shell Lateral	station 960 WL 271-290	0.66 to 1.7
Transverse Floor Beams-Vertical	station 620 station 820 station 960	0.61 to 1.27 0.84 to 1.6 1.1 to 3.0
Upper Cabin Longeron Vertical	station 460-620 WL 205-271/WL 271-290	0.67 to 1.06/0.34 to 0.69
	station 620-820 WL 205/271/WL 271-290	0.64 to 2.87/0.76 to 1.09
	station 820-960 WL 205-271/WL 271-290	0.56 to 0.78/0.40 to 1.04
	station 960-1040 WL 205-271/WL 271-290	0.26 to 1.16/0.15 to 0.55
	station 1040-1200 WL 205-271/WL 271-290	1.02 to 2.7/0.36 to 1.69
Floor Vertical Inboard	station 460-620 station 620-820 station 820-960 station 960-1040 station 1040-1200	1.71 to 2.46 1.81 to 5.9 0.37 to 0.86 0.33 to 3.1 1.7 to 2.1
Outboard	station 460-620 station 620-820 station 820-960 station 960-1040	0.69 to 1.44 0.50 to 2.18 0.91 to 0.98 0.62 to 0.88

of 17 ft/sec. The ensemble of data presented shows the inverse relationship between pulse amplitude and duration. The data cluster about the constant ΔV curve. The stick model results tend to be of a lower amplitude and broader in duration than the refined model for 50 Hz filtered data. As the data are filtered lower to 25 Hz, the points shift to the right and lower. Lower filtering to 10 Hz (not shown) shifts the responses more to the right and lower and tends to show better agreement between the two models. The aforementioned observations are based on earlier models with the original load-deflection curves. While the results vary somewhat with the refined curves, the same relationship will hold, as can be observed from the response data in Tables 5-2 and 6-9.

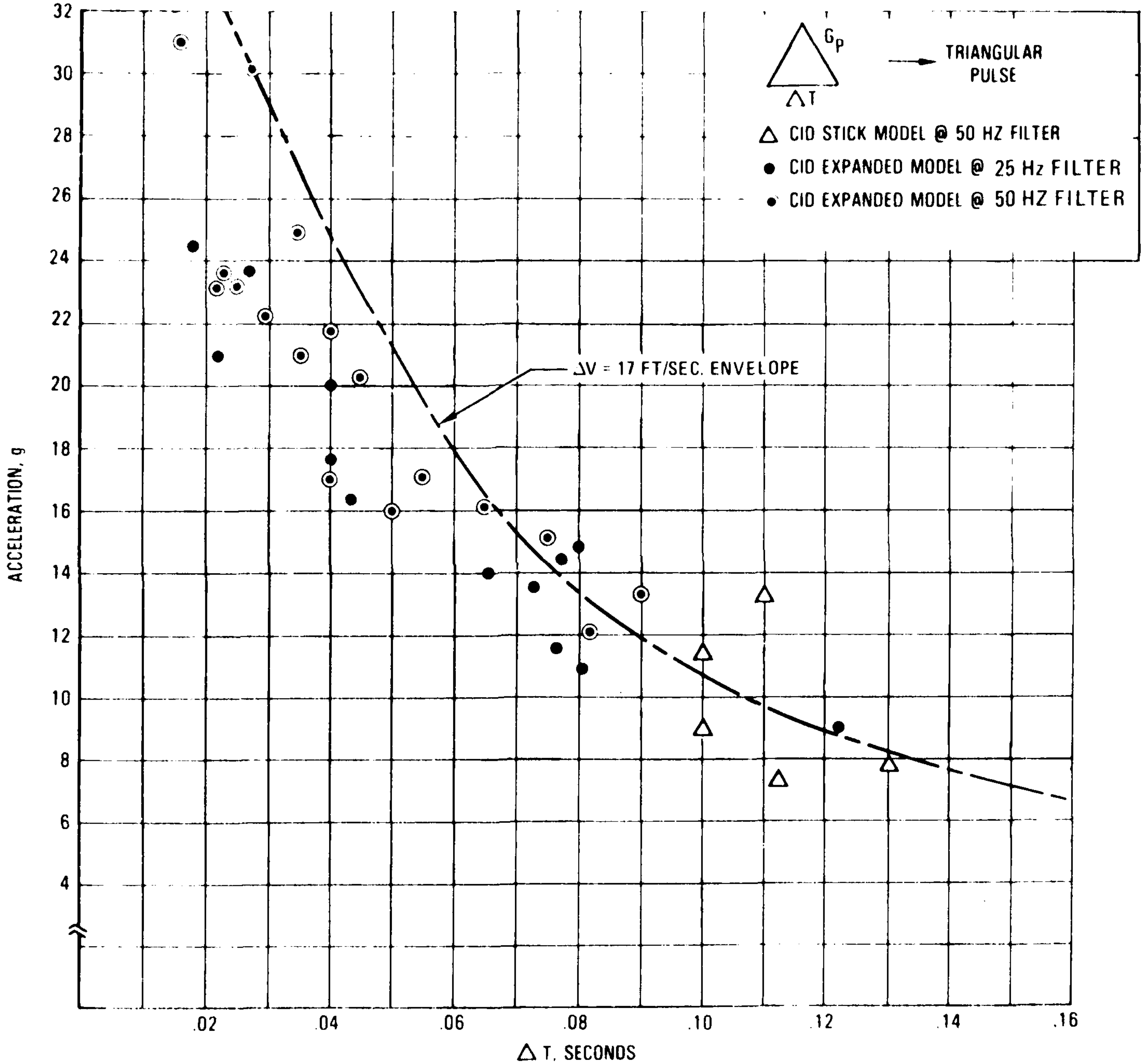


FIGURE 6-3. CID PRE-TEST ANALYSIS - VERTICAL ACCELERATION PULSES, 17 FT/SEC, +1° NOSE-UP

A representative KRASH analysis result for the expanded model (condition 1) is shown in Figure 6-4. Unfiltered and filtered (50 Hz) accelerations, as well as impulse (g-sec) response data for FS820 (wing-center section) floor centerline is presented. The unfiltered peak acceleration values are 13.3 g and 2.8 g for the vertical and longitudinal directions, respectively. The corresponding filtered data shows 12.04 g and 2.5 g respectively. Two vertical pulses are detectable in the filtered data. A 12.05 g, .060 sec duration and a 8.78 g, 060 sec. duration. However from the impulse data a broader 120 second pulse can be deduced with an average acceleration value of 5.3 g, which translates to a 10.6 g peak for a triangular pulse of equal duration. The corresponding longitudinal triangular would be approximately 2.7 g for a .140 second duration. The floor responses at fuselage stations 300 to 1400, along both the centerline and at the floor/frame intersection for the expanded model, condition 1, are provided in Appendix B.

A comparison of the stick and expanded models for the ranges of conditions described in Section 5 and 6, based on impulse data is shown in Figure 6-5. The corresponding acceleration data for the two cases (stick model, condition 3 and expanded model, condition 1) which most resemble each other is shown in Figure 6-6. The predicted responses based on these two conditions are shown in Figure 6-7 for L/C ratios, accelerations and crush for the planned impact.

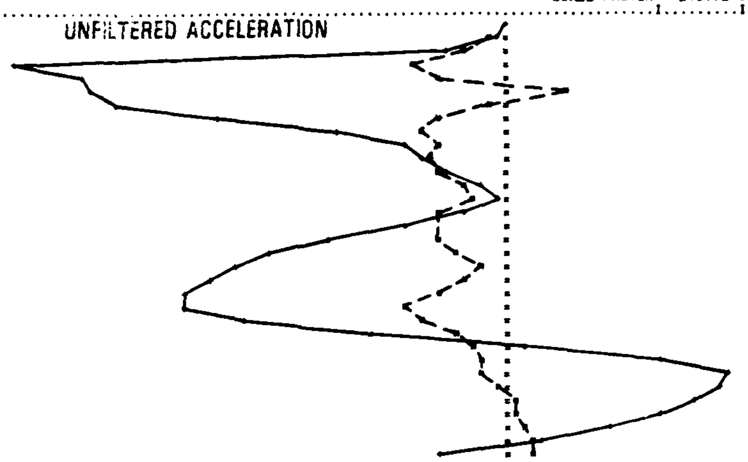
Based on the structural damage noted in the B707 airplane drop test at Laurinburg, N.C. (Section 5 discussion), the peak vertical acceleration would be expected to occur closer to FS820. If the test results substantiate this then the modeling of the center wing box region and its attachment to the wing should be further evaluated.

Based on the analysis results shown in Table 6-10 the highest potential for failures is from fuselage station 990 to 1080. However, from the model results it is doubtful that fuselage shell strength would be exceeded, unless the hardpoint springs at FS620, 820 and 960 bottom out (restiffen) at a lower crush deflection than used in the analysis.

MASS 5 UNFILTERED ACCELERATION(G'S)

SCALE FACTOR = 2.297E+00

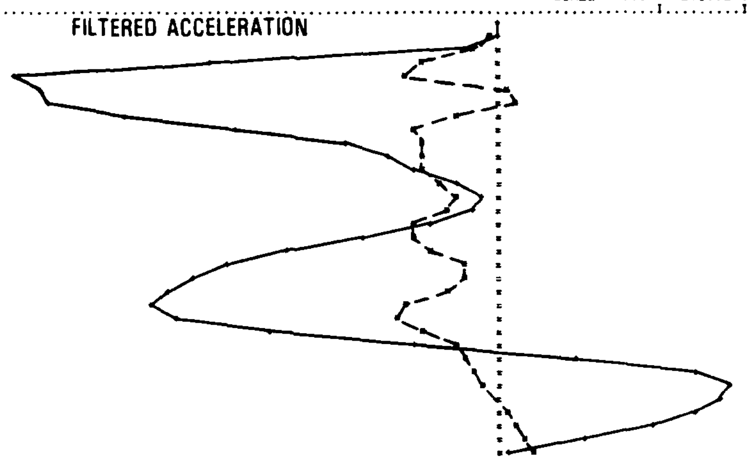
TIME(SEC)	XACC	YACC	ZACC
0.0	1.311E-02	0.0	-2.681E-02
0.005	-4.358E-01	0.0	-2.163E-01
0.010	-1.244E+00	0.0	-1.648E+00
0.015	-2.467E+00	0.0	-1.331E+01
0.020	-1.872E+00	0.0	-1.152E+01
0.025	1.547E+00	0.0	-1.136E+01
0.030	-3.751E-01	0.0	-1.057E+01
0.035	-1.895E+00	0.0	-7.819E+00
0.040	-2.180E+00	0.0	-4.668E+00
0.045	-1.842E+00	0.0	-2.696E+00
0.050	-2.118E+00	0.0	-2.358E+00
0.055	-1.843E+00	0.0	-1.686E+00
0.060	-1.187E+00	0.0	-5.728E-01
0.065	-9.454E-01	0.0	-2.909E-01
0.070	-1.845E+00	0.0	-1.110E+00
0.075	-2.683E+00	0.0	-2.720E+00
0.080	-1.793E+00	0.0	-4.745E+00
0.085	-1.413E+00	0.0	-6.352E+00
0.090	-5.774E-01	0.0	-7.421E+00
0.095	-1.158E+00	0.0	-8.067E+00
0.100	-1.914E+00	0.0	-8.731E+00
0.105	-2.789E+00	0.0	-8.821E+00
0.110	-2.384E+00	0.0	-7.171E+00
0.115	-1.405E+00	0.0	-3.772E+00
0.120	-9.024E-01	0.0	4.116E-01
0.125	-6.993E-01	0.0	4.072E+00
0.130	-7.469E-01	0.0	5.982E+00
0.135	-1.661E-01	0.0	5.648E+00
0.140	1.323E-01	0.0	5.067E+00
0.145	2.055E-01	0.0	4.190E+00
0.150	5.523E-01	0.0	2.754E+00
0.155	7.511E-01	0.0	8.841E-01
0.160	7.598E-01	0.0	-1.786E+00



MASS 5 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 2.099E+00

TIME(SEC)	XACCF	YACCF	ZACCF
0.0	0.0	0.0	0.0
0.005	-2.615E-01	0.0	-6.510E-02
0.010	-7.062E-01	0.0	-8.250E-01
0.015	-2.049E+00	0.0	-7.292E+00
0.020	-2.412E+00	0.0	-1.204E+01
0.025	1.250E-01	0.0	-1.149E+01
0.030	2.777E-01	0.0	-1.111E+01
0.035	-1.025E+00	0.0	-9.407E+00
0.040	-2.103E+00	0.0	-6.583E+00
0.045	-1.886E+00	0.0	-3.948E+00
0.050	-2.035E+00	0.0	-2.747E+00
0.055	-2.008E+00	0.0	-2.193E+00
0.060	-1.598E+00	0.0	-1.211E+00
0.065	-1.113E+00	0.0	-4.936E-01
0.070	-1.282E+00	0.0	-6.761E-01
0.075	-2.170E+00	0.0	-1.759E+00
0.080	-2.210E+00	0.0	-3.533E+00
0.085	-1.706E+00	0.0	-5.328E+00
0.090	-9.563E-01	0.0	-6.702E+00
0.095	-9.582E-01	0.0	-7.604E+00
0.100	-1.399E+00	0.0	-8.292E+00
0.105	-2.346E+00	0.0	-8.783E+00
0.110	-2.515E+00	0.0	-8.114E+00
0.115	-1.965E+00	0.0	-5.774E+00
0.120	-1.208E+00	0.0	-2.116E+00
0.125	-8.722E-01	0.0	1.766E+00
0.130	-7.193E-01	0.0	4.784E+00
0.135	-4.899E-01	0.0	5.589E+00
0.140	-1.676E-02	0.0	5.361E+00
0.145	9.654E-02	0.0	4.722E+00
0.150	3.597E-01	0.0	3.626E+00
0.155	6.172E-01	0.0	2.023E+00
0.160	7.456E-01	0.0	1.345E-01



MASS 5 MASS IMPULSES

SCALE FACTOR = 7.591E-02

TIME(SEC)	XIMP	YIMP	ZIMP
0.0	0.0	0.0	0.0
0.005	-5.700E-04	0.0	-1.057E-04
0.010	-2.78[illegible]E-03	0.0	-1.920E-03
0.015	-1.00[illegible]E-02	0.0	-1.866E-02
0.020	-2.185E-02	0.0	-7.259E-02
0.025	[illegible]	0.0	-1.309E-01
0.030	-2.562E-02	0.0	-1.876E-01
0.035	-2.7[illegible]E-02	0.0	-2.395E-01
0.040	-3.567E-02	0.0	-2.795E-01
0.045	-4.593E-02	0.0	-3.052E-01
0.050	-5.568E-02	0.0	-3.213E-01
0.055	-6.601E-02	0.0	-3.3[illegible]E-01
0.060	-7.519E-02	0.0	-3.425E-01
0.065	-8.175E-02	0.0	-3.462E-01
0.070	-8.726E-02	0.0	-3.487E-01
0.075	-9.60[illegible]E-02	0.0	-3.545E-01
0.080	-1.0[illegible]E-01	0.0	-3.677E-01
0.085	-1.172E-01	0.0	-3.901E-01
0.090	-1.24[illegible]E-01	0.0	-4.20[illegible]E-01
0.095	-1.28[illegible]E-01	0.0	-4.56[illegible]E-01
0.100	-1.34[illegible]E-01	0.0	-4.96[illegible]E-01
0.105	-1.4[illegible]E-01	0.0	-5.393E-01
0.110	-1.56[illegible]E-01	0.0	-5.8[illegible]E-01
0.115	-1.675E-01	0.0	-6.174E-01
0.120	-1.752E-01	0.0	-6.372E-01
0.125	-1.803E-01	0.0	-6.377E-01
0.130	-1.84[illegible]E-01	0.0	-6.204E-01
0.135	-1.876E-01	0.0	-5.937E-01
0.140	-1.8[illegible]E-01	0.0	-5.661E-01
0.145	-1.8[illegible]E-01	0.0	-5.408E-01
0.150	-1.872E-01	0.0	-5.198E-01
0.155	-1.847E-01	0.0	-5.056E-01
0.160	-1.812E-01	0.0	-5.002E-01

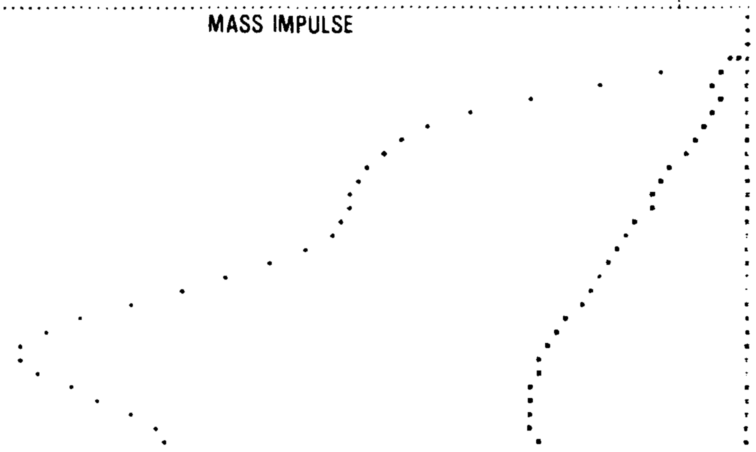


FIGURE 6-4. ACCELERATION RESPONSE AT FS820 CENTERLINE, EXPANDED MODEL CONDITION 1

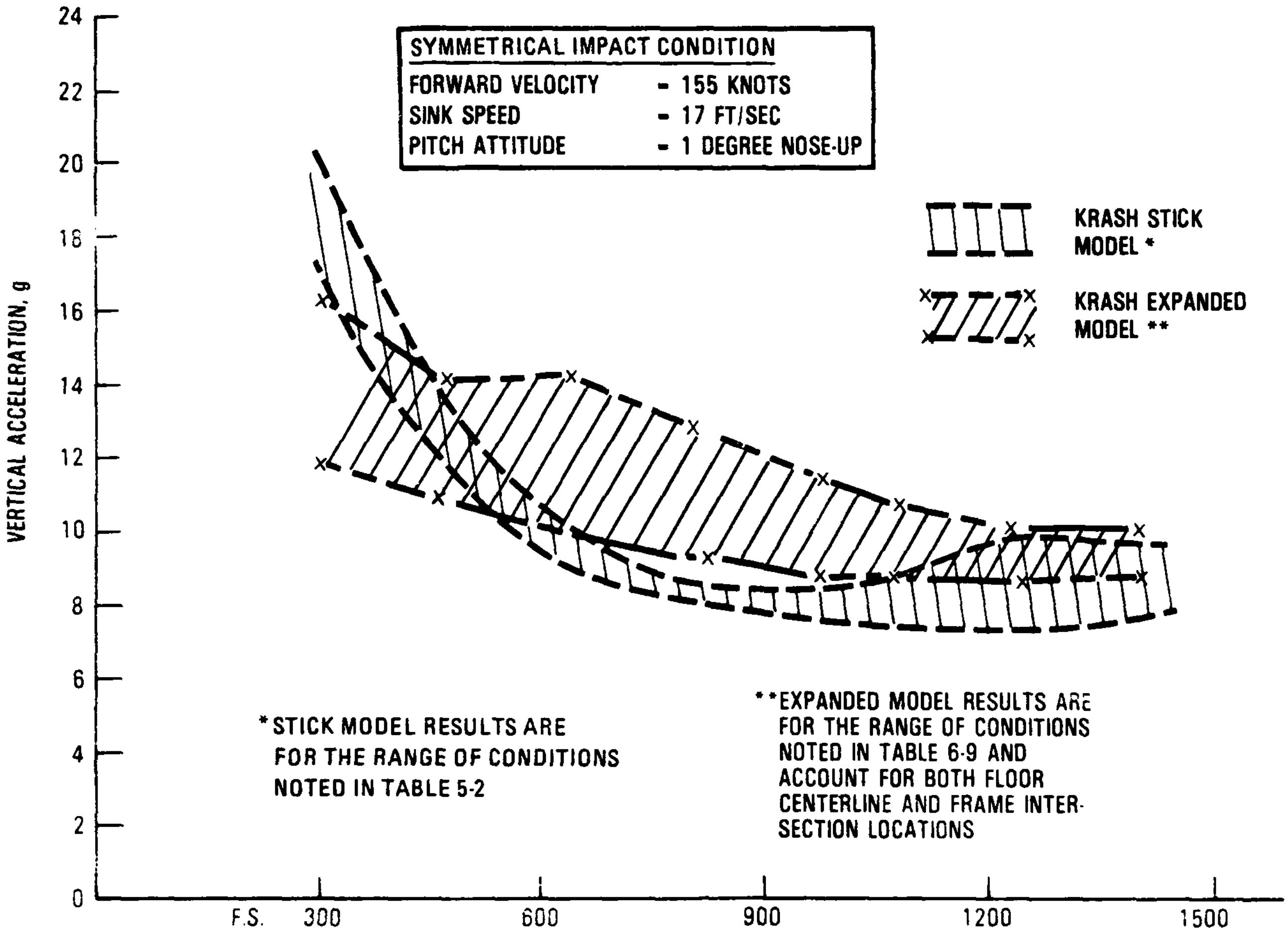


FIGURE 6-5. COMPARISON OF PRE-CID KRASH STICK MODEL ANALYSES VERSUS EXPANDED MODEL RESULTS FOR PLANNED SYMMETRICAL IMPACT CONDITION

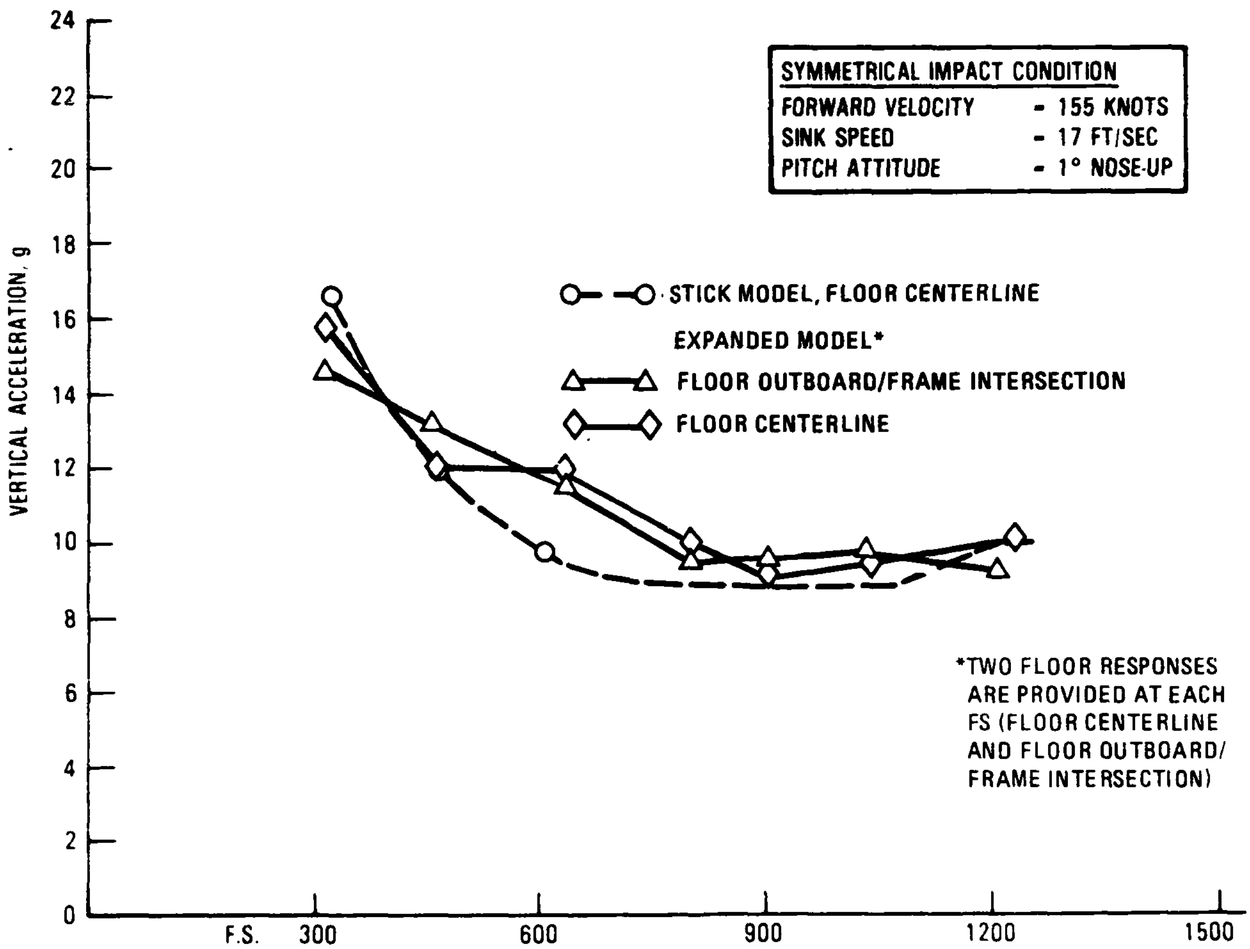


FIGURE 6-6. COMPARISON OF PRE-CID KRASH STICK AND EXPANDED MODELS ANALYSES RESULTS FOR PLANNED SYMMETRICAL IMPACT CONDITION

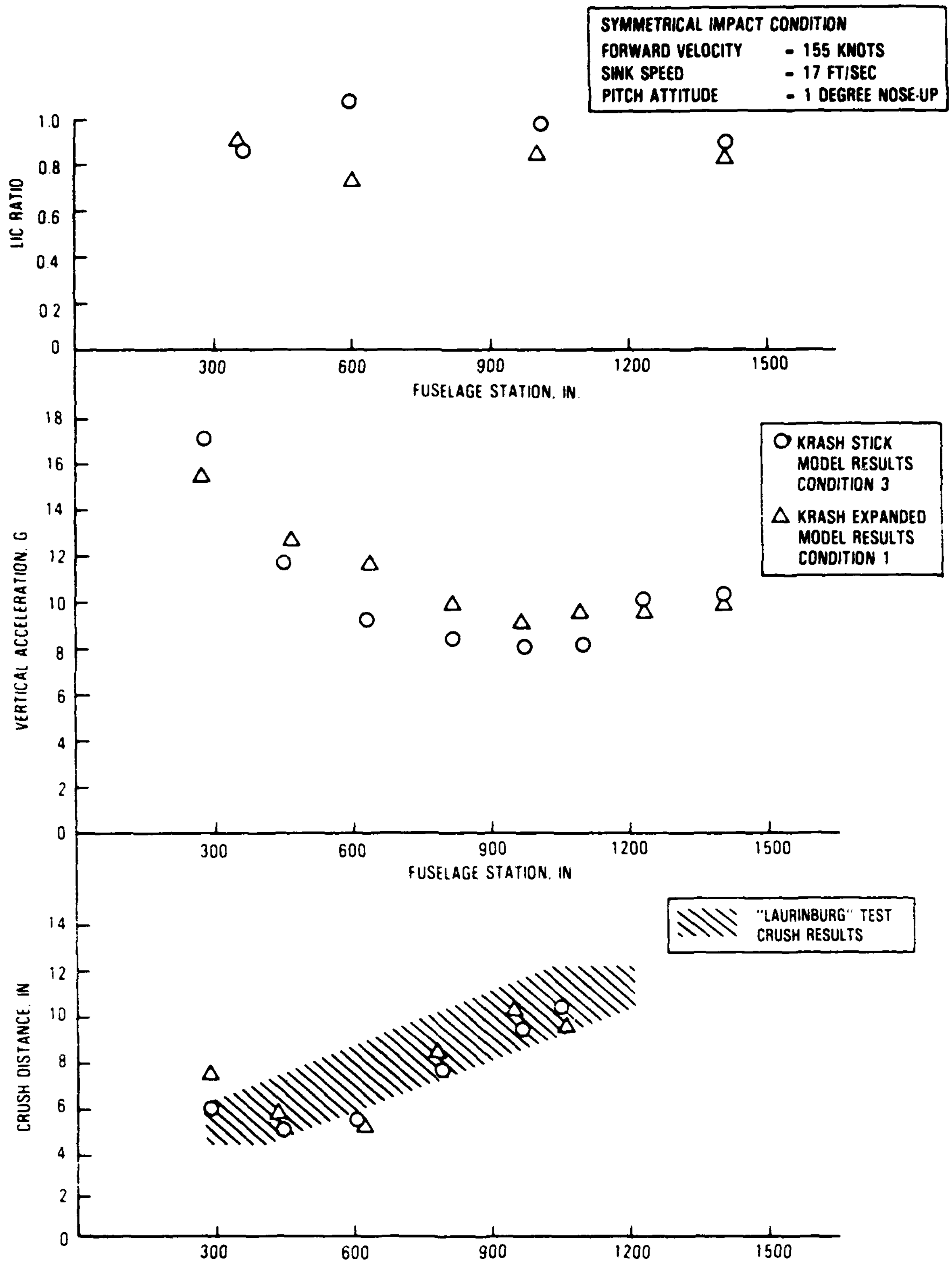


FIGURE 6-7. PRE-CID TESTS KRASH ANALYSIS RESULTS FOR PLANNED SYMMETRICAL IMPACT CONDITION

The analysis results are particularly sensitive to:

- The representation of the hard point load-deflection characteristics. Bottoming out loads could easily result in localized failures and subsequent disruption of structural integrity.
- Extent to which structure yields or fails. This is difficult to model because a large segment of structure, consisting of several frames and stringers, is defined by only a few beam elements.
- The expanded model results in higher frequency responses than the stick model. This is evidenced in the peak responses. The lower acceleration peaks with longer time durations obtained from the stick model results (Section 5) are probably more realistic than the expanded model results.

SECTION 7

CONCLUSIONS

CONCLUSIONS

1. The CID pre-test analysis indicates responses and structural damage similar to that experienced for the B707 airplane drop test conducted in Laurinburg N.C., for a symmetrical 17 ft/sec impact and the airplane at a 1 degree nose-up attitude.

2. Analysis of frame sections subjected to vertical impact loading can be performed to obtain overall section load-deflection behavior for use in larger airframe mathematical models.

3. The hard point load-deflection behavior is the most significant parameter which influences the potential for loss of structural integrity and cause of severe injury to occupants in a crash.

4. Analytical modeling results are influenced by the representation of yield and/or rupture allowables. Representation of large regions of structure by simpler elements will be enhanced with additional methodology development.

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APPENDIX A

A.1 NARROW-BODY AIRPLANE KRASH FRAME MODEL

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                   1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

     1   NBSTRUCT.MASS11.DATA 02-05-84 FULL FRAME REV.WT.4/4 CASE114 PL(1/7)=.60 00000010
     2   B707 SECT.PL=1.0 20FPS 10%DAMP SOFT TOP K(FR)=1 K(FL)=1  5E-5DT  50HZ   00000020
     3   12345678901234567890123456789012345678901234567890123456789012345678901200000030
     4       NM  NSP   NB  NLB  NNP NPIN  NUB NDRINOLEO NACC  MVP NVCH NMTL   ND 00000040
     5       11    4   12    2    3    7    0    0    0    0    0    0    0    3 00000050
     6     NVBM NFBMNVBMNNFBMN  NKM  NHI  NPH TOL1 TOL2 TOL3  NSC  NICNAERONBOMB 00000060
     7        0    0    1    1    0    0    0 1000 1000 1000    0    1    0    1 00000070
     8     NSCV NLICNWRGR NBAL  ICDICITR                                         00000071
     9                                                                           00000072
    10   GRAPHIC AND DATA TRANSFER CARDS                                         00000080
    11                                                                           00000090
    12                                                                           00000100
    13   ONE START AND ONE RESTART CARD                                          00000110
    14                                                                           00000120
    15                                                                           00000130
    16       IPRINT DELTAT          TMAX      PLOWT       FCUT      RUNMOD       00000140
    17          100 0.00005         .000                   40.        1.0        00000150
    18     BLANK CARD FOLLOWS                                                    00000160
    19                                                                           00000170
    20     NSF  NTF  NDE NSPD  NED   NS  NRP NIMP: PRINT DAT                     00000180
    21       0    0    0    0    0    0    0    0                                00000190
    22    NMEP NNEP NBFP NBDP NSTP NSEP NENP NDRP NPLTNPFCT:PLOT DATA            00000200
    23       5    0    7    7    0    4    0    0    1   10                      00000210
    24    INITIAL CONDITION DATA:3 CARDS                                         00000220
    25     0.0       0.0       240.                                              00000230
    26     0.0       0.0         0.                                              00000240
    27     0.        0.          0.        0.        0.       0.                 00000250
    28    MASS DATA:NM CARDS                                                     00000260
    29          18.0      0.0      -20.        4.        4.        4.        4.  00000270
    30          18.0      0.0      -37.       12.        4.        4.        4.  00000280
    31          18.0      0.0      -52.       25.        4.        4.        4.  00000290
    32          51.       0.0      -70.       69.       16.       16.       16.  00000300
    33          51.       0.0      -45.4      69.       16.       16.       16.  00000310
    34          51.       0.       -24.8      69.       16.       16.       16.  00000320
    35          18.       0.         0.        1.        4.        4.        4.  00000330
    36         450.       0.       -35.1      89.      125.      125.      125.  00000340
    37          27.       0.       -72.      110.        8.        8.        8.  00000350
    38          32.       0.       -60.      140.        8.        8.        8.  00000360
    39          40.       0.         0.      176.       10.       10.       10.  00000370
    40    NODE PT.DATA: NNP CARDS                                                00000380
    41       1    1       0.         0.        1.                                00000390
    42       1    8       0.       -45.4      89.                                00000400
    43       2    8       0.       -24.8      89.                                00000410
    44    EXTERNAL SPRING DATA:2XNSP CARDS                                       00000420
    45       1    3       1.0        0.    10000.        0.        0.            00000430
    46       7    3       1.         0.    10000.        0.        0.            00000440
    47       2    3       1.0        0.    10000.        0.        0.            00000450
    48       3    3       1.         0.    10000.                                00000460
    49            0.6     0.65      .66       0.9     4000.     4000.    .00001  00000470
    50            0.6     0.65      .66       0.9     4000.     4000.   0.00001  00000480
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                 1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   51          0.6       0.65       .66       0.9     4000.     4000.    .00001  00000490
   52          0.6       0.65       .66       0.9     4000.     4000.    .00001  00000500
   53    INTERNAL BEAM DATA:NB CARDS                                              00000510
   54      1    7       1.2                   1.4       1.4          1.00     1.0 400000520
   55      1    2       1.20                  1.4       1.4          1.00     1.0 400000530
   56      2    3       1.20                  1.4       1.4          1.00     1.0 400000540
   57      3    4       1.20                  1.4       1.4          1.00     1.0 400000550
   58      4    5       0.90                  8.8       .16          5.00     1.0 400000560
   59      5    6       0.90                  8.8       .16          5.       1.  400000570
   60      6    0       0.90                  8.8       .16          5.       1.  400000580
   61      4    9       1.1                   1.2       1.2          1.0      1.  400000590
   62      9   10       1.2                   1.4       1.4          1.0      1.  400000600
   63     10   11       1.2                   1.4       1.4          1.0      1.  400000610
   64      5 1  8       0.28                  .04       .04           .5       .5 100000620
   65      6 2  8       0.28                  .04       .04           .5       .5 100000630
   66    BEAM END FIXITY DATA: NPIN CARDS                                         00000640
   67      1    2    1    1    0    0    1.00      1.00      0.00      0.00      00000650
   68      2    3    1    1    0    0    1.00      1.00      0.00      0.00      00000660
   69      3    4    1    1    0    0    1.00      1.00      0.00      0.00      00000670
   70      1    7    0    0    1    1    0.00      0.00      0.60      0.60      00000680
   71      4    9    0    0    1    1    0.0       0.        1.0       1.0       00000690
   72      9   10    0    0    1    1    0.        0.        1.0       1.0       00000700
   73     10   11    0    0    1    1    0.        0.        1.0       1.0       00000710
   74    DAMPC CARD                                                               00000720
   75    0.10000                                                                  00000730
   76    NONSTD BEAM DAMPING:ND CARDS                                             00000740
   77      1    7     .00001                                                      00000750
   78      5 1  8     .10                                                         00000751
   79      6 2  8     .10                                                         00000752
   80    NONLINEAR BEAM DATA:NLB CARDS                                            00000760
   81      5 1  8    1    10                                                      00000820
   82      6 2  8    1    10                                                      00000830
   83      0.         1.0                                                         00000840
   84      1.         1.0                                                         00000850
   85      1.5        1.0                                                         00000860
   86      2.         1.0                                                         00000870
   87      2.5        1.0                                                         00000880
   88      3.         1.0                                                         00000890
   89      3.1        1.0                                                         00000900
   90      3.2        1.0                                                         00000910
   91      3.4       1.0                                                          00000920
   92      3.5       1.0                                                          00000930
   93      0.         1.0                                                         00000940
   94      1.         1.0                                                         00000950
   95      1.5        1.0                                                         00000960
   96      2.         1.0                                                         00000970
   97      2.5        1.0                                                         00000980
   98      3.         1.0                                                         00000990
   99      3.1        1.0                                                         00001000
  100      3.2        1.0                                                         00001010
  101      3.4       1.0                                                          00001020
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

    102      3.5      1.0                                                        00001030
    103   BEAM NEG.DEFL.CUTOFF :NVBMN CARDS                                      00001040
    104      1    7    1.E+10    1.E+10      100.    1.E+10    1.E+10    1.E+10  00001050
    105   BEAM NEG.FORCE CUTOFF:NFBMN CARDS                                      00001060
    106      1    7    1.E+10    1.E+10    1.E+10    1.E+10    1.E+10    1.E+10  00001070
    107   POSITION PLOT DATA:2XNPLT CARDS                                        00001080
    108      3   11    3          10.0      30.0                                 00001090
    109      1    2    3    4    5    6    7    8    9   10   11                 00001100
    110   MASS PLOT DATA: NMEP CARDS                                             00001110
    111      4    1    0    1              1    1    0                           00001140
    112      5    1    0    1              1    1    0                           00001150
    113      6    1    0    1              1    1    0                           00001160
    114      8    1    0    1              1    1    0                           00001180
    115     11    1         1              1    1                                00001210
    116   BEAM FORCE PLOT DATA:NBFP CARDS                                        00001220
    117      1    1    1    1                                                    00001235
    118      4    1    1    1                                                    00001240
    119      5    1    1    1                                                    00001250
    120      6    1    1    1                                                    00001260
    121      7    1    1    1                                                    00001270
    122     11    1    1    1                                                    00001310
    123     12    1    1    1                                                    00001320
    124   BEAM DEFLECTION PLOT DATA:NBDP CARDS                                   00001330
    125      1    1    1    1                                                    00001335
    126      4    1    1    1                                                    00001350
    127      5    1    1    1                                                    00001360
    128      6    1    1    1                                                    00001370
    129      7    1    1    1                                                    00001380
    130     11    1    1    1                                                    00001420
    131     12    1    1    1                                                    00001430
    132   EXTERNAL SPRING DATA:NSEP CARDS                                        00001440
    133      1         1    1                                                    00001450
    134      2         1    1                                                    00001460
    135      3         1    1                                                    00001470
    136      7         1    1                                                    00001480
    137  END                                                                     00001490
```

A.2 WIDE-BODY AIRPLANE KRASH FRAME MODEL

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                              ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

                   1         2         3         4         5         6         7         8
CARD NO.  12345678901234567890123456789012345678901234567890123456789012345678901234567890

     1    FRAME.MOD7.DATA 8-21-84                                                 00000010
     2    WIDE-BODY SECTION 14MASS 20FPS                                          00000020
     3    12345678901234567890123456789012345678901234567890123456789012345678901200000030
     4      NM   NSP    NB   NLB   NNP  NPIN   NUB NDRINOLEO NACC   MVP NVCH NMTL    ND 00000040
     5      14     3    16     0     2     4     0     0     0     0     0     0     0     0 00000050
     6     NVBM NFBMNVBMNNFBMN   NKM   NHI   NPH  TOL1  TOL2  TOL3   NSC  NICNAERONBOMB 00000060
     7        0     1     0     0     0     0     0  1000  1000  1000     0     1     0     1 00000070
     8     NSCV NLICNWRGR NBAL   ICD                                              00000080
     9        0     0     0     0     0                                          00000090
    10    GRAPHIC AND DATA TRANSFER CARDS                                         00000100
    11                                                                            00000110
    12                                                                            00000120
    13    ONE START AND ONE RESTART CARD                                          00000130
    14                                                                            00000140
    15                                                                            00000150
    16        IPRINT DELTAT        TMAX      PLOWT       FCUT     RUNMOD          00000160
    17           250 0.00001       .100                   50.        1.0          00000170
    18      BLANK CARD FOLLOWS                                                    00000180
    19                                                                            00000190
    20      NSF   NTF   NDE  NSPD   NED    NS   NRP NIMP: PRINT DAT               00000200
    21        1     1     1     1     1     0     1     0                         00000210
    22     NMEP  NNEP  NBFP  NBDP  NSTP  NSEP  NENP  NDRP  NPLTNPFCT:PLOT DATA    00000220
    23       14     2    16    16     0     3     0     0     1     4             00000230
    24     INITIAL CONDITION DATA:3 CARDS                                         00000240
    25      0.0         0.0        240.                                           00000250
    26      0.0         0.0          0.                                           00000260
    27      0.          0.0          0.         0.          0.        0.          00000270
    28     MASS DATA:NM CARDS                                                     00000280
    29          20.          0.          0.          2.0        2.0        2.0        2.0 00000290
    30          25.00        0.00       17.0         3.24       4.00       4.00       4.00 00000300
    31          35.00        0.00       55.00       15.00       6.00       6.00       6.00 00000310
    32          30.00        0.00       83.00       36.00       6.00       6.00       6.00 00000320
    33          30.          0.        100.         65.         6.         6.         6.   00000330
    34          75.00        0.00      110.00       93.00      24.00      24.00      24.00 00000340
    35          75.00        0.00       83.00       93.00      24.00      24.00      24.00 00000350
    36          75.00        0.00        0.00       93.00      24.00      24.00      24.00 00000360
    37          40.00        0.00       92.00      162.00      12.00      12.00      12.00 00000370
    38          45.00        0.00       55.00      203.00      12.00      12.00      12.00 00000380
    39          60.00        0.00        0.00      220.00      15.00      15.00      15.00 00000390
    40         165.          0.          0.        113.        47.25      47.25      47.25 00000400
    41          82.5         0.         83.        113.        23.63      23.63      23.63 00000410
    42          20.          0.         17.0        15.         4.         4.         4.   00000420
    43     MASSLESS NODE POINT DATA: NNP CARDS                                    00000430
    44        1     2       0.3         17.0         3.24                         00000440
    45        1    14       0.3         17.0        15.0                          00000450
    46     EXTERNAL SPRING DATA:2XNSP CARDS                                       00000460
    47        1     3       2.00        0.00  20000.00       0.00       0.00      00000470
    48        2     3       2.00        0.00  20000.00       0.00       0.00      00000480
    49        3     3       2.00        0.00  20000.00       0.00       0.00      00000490
    50           0.40       0.75        0.85      1.00    4000.00    5000.00    0.00001 00000500
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                   1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   51        0.40      0.75      0.85      1.00   4000.00   5000.00   0.00001  00000510
   52        0.40      0.75      0.85      1.00   4000.00   5000.00   0.00001  00000520
   53    INTERNAL BEAM DATA:NB CARDS                                           00000530
   54       3   14     0.47      0.5       1.3       1.3            1.0     1.0 400000540
   55       2    3     2.32      3.0       3.34      3.34           3.0     1.5 400000550
   56       4   71     0.39                0.77      0.77           1.50    1.5 400000560
   57       3    4     2.28                3.30      3.30           1.50    1.0 400000570
   58       4    5     2.38                4.5       4.5            2.25    1.  400000580
   59       5    6     2.48                5.0       5.0            2.5     1.  400000590
   60       6    7     0.75               15.20     15.20           5.00    1.0 400000600
   61       7    8     0.75               15.20     15.20           5.00    1.0 400000610
   62       6    9     2.27                4.20      4.20           2.00    1.0 400000620
   63       9   10     2.11                3.90      3.90           2.00    1.0 400000630
   64      10   11     1.90                3.60      3.60           1.80    1.0 400000640
   65       8  121     0.80                0.04      0.04           0.50    0.5 100000650
   66       7  131     0.80                0.04      0.04           0.50    0.5 100000660
   67    1  2 1 141   0.328              0.0195     0.537            .57    1.7 400000670
   68       1    2     2.28      3.0       3.95      3.95           3.0     1.5 400000680
   69      14    0     0.47                1.3       1.3            1.0     1.0 400000690
   70    BEAM END FIXITY DATA: NPIN CARDS                                      00000700
   71       1    2    1    1    0    0 0.75      0.75      0.0       0.0       00000710
   72       2    3    1    1    0    0 0.75      0.75      0.0       0.0       00000720
   73       3    4    1    1    0    0 1.0       1.0       0.0       0.0       00000730
   74       7    8    0    0    1    1 0.0       0.0       1.0       1.0       00000740
   75    DAMPC CARD                                                            00000770
   76    0.01000                                                               00000780
   77    NON STANDARD MAX BEAM ELEMENT POS LOAD: NFBM CARD                     00000790
   78    1  2 1 14    1.0E10    1.0E10    1.0E10    1.0E10 1500.0       1.0E10  00000800
   79    POSITION PLOT DATA:2XNPLT CARDS                                       00000810
   80       3   14    3         20.0      40.0                                 00000820
   81       1    2    3    4    5    6    7    8    9   10   11   12   13   14 00000830
   82    MASS PLOT DATA: NMEP CARDS                                            00000840
   83       1    1    1    1                   1                               00000850
   84       2    1    1    1                   1                               00000860
   85       3    1         1                   1                               00000870
   86       4    1         1                   1                               00000880
   87       5    1         1                   1                               00000890
   88       6    1         1                   1                               00000900
   89       7    1         1                   1                               00000910
   90       8    1                             1                               00000920
   91       9    1                             1                               00000930
   92      10    1                             1                               00000940
   93      11    1                             1                               00000950
   94      12    1                             1                               00000960
   95      13    1                             1                               00000970
   96      14    1    1    1                   1                               00000980
   97    MASSLESS NODE POINT DATA: NNEP CARDS                                  00000990
   98       1    2    1                                                        00001000
   99       1   14    1                                                        00001010
  100    BEAM FORCE PLOT DATA:NBFP CARDS                                       00001020
  101       1    1    1    1                                                   00001030
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   102       2    1    1    1                                                    00001040
   103       3    1    1    1                                                    00001050
   104       4    1    1    1                                                    00001060
   105       5    1    1    1                                                    00001070
   106       6    1    1    1                                                    00001080
   107       7    1    1    1                                                    00001090
   108       8    1    1    1                                                    00001100
   109       9    1    1    1                                                    00001110
   110      10    1    1    1                                                    00001120
   111      11    1    1    1                                                    00001130
   112      12    1    1    1                                                    00001140
   113      13    1    1    1                                                    00001150
   114      14    1    1    1                                                    00001160
   115      15    1    1    1                                                    00001170
   116      16    1    1    1                                                    00001180
   117    BEAM DEFLECTION PLOT DATA:NBDP CARDS                                   00001190
   118       1    1    1    1                                                    00001200
   119       2    1    1    1                                                    00001210
   120       3    1    1    1                                                    00001220
   121       4    1    1    1                                                    00001230
   122       5    1    1    1                                                    00001240
   123       6    1    1    1                                                    00001250
   124       7    1    1    1                                                    00001260
   125       8    1    1    1                                                    00001270
   126       9    1    1    1                                                    00001280
   127      10    1    1    1                                                    00001290
   128      11    1    1    1                                                    00001300
   129      12    1    1    1                                                    00001310
   130      13    1    1    1                                                    00001320
   131      14    1    1    1                                                    00001330
   132      15    1    1    1                                                    00001340
   133      16    1    1    1                                                    00001350
   134    EXTERNAL SPRING DATA:NSEP CARDS                                        00001360
   135       1         1    1                                                    00001370
   136       2         1    1                                                    00001380
   137       3         1    1                                                    00001390
   138   END                                                                     00001400
```

A.3 KRASH CID STICK MODEL

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

       1 B720.NASTI.LICK.DATA 8-07-84 1E-4DT ELKD 100%A,I,MOM,80%STR, 193K       00000010
       2 155 KTS. 01 PTCH SYM.17 ROD-RIG.GRD MU=.35RAT.AERO DAMPC=.100 TMAX=.16  00000020
       3 12345678901234567890123456789012345678901234567890123456789012345678901200000030
       4    NM  NSP   NB  NLB  NNP NPIN  NUB NDRINOLEO NACC  MVP NVCH NMTL   ND  00000040
       5    17   12   16    0   11    6    0    0    0   17    0    0    0    0  00000050
       6  NVBM NFBMNVBMNNFBMN  NKM  NHI  NPH TOL1 TOL2 TOL3  NSC  NICNAERONBOMB  00000060
       7     0    0    0    2    0    0    0 1000 1000 1000    0    0    0    1  00000070
       8  NSCV NLICNWRGR NBAL  ICDICITR                                          00000080
       9     1   16    0    5    1    1                                          00000090
      10 GRAPHICS                                                                00000100
      11                                                                         00000110
      12                                                                     50  00000120
      13 ONE RESTART AND ONE SAVE CARD FOLLOWS                                   00000130
      14                                                                         00000140
      15                                                                         00000150
      16      IPRINT  DELTAT    TMAX     PLOWT      FCUT       RUNMOD            00000160
      17         50 .000100   0.160    0.000      50.         1.                 00000170
      18 BLANK CARD FOLLOWS                                                      00000180
      19                                                                         00000190
      20   NSF  NTF  NDE NSPD  NED   NS  NRP NIMP : PRINT DATA                   00000200
      21     0    0    0    0    0    0    0    0                                00000210
      22  NMEP NNEP NBFP NBDP NSTP NSEP NENP NDRP NPLTNPFCT : PLOT DATA          00000220
      23    11    0   16   16    0    9    0    0    0    0                      00000230
      24 INITIAL CONDITION DATA : 3 CARDS                                        00000240
      25    3140.00    000.00    204.00                                          00000250
      26     000.00    000.00    000.00                                          00000260
      27     000.00  0.01745     000.00    000.00  000000.       0.001.1463E-07  00000270
      28 MASS DATA : NM CARDS                                                    00000280
      29     1585.0     199.0       0.0     219.0.11514E+05.4    E+05.15   E+05  00000290
      30    10064.5     300.0       0.0     217.9.89080E+05.3    E+06.99   E+05  00000300
      31    15318.1     460.0       0.0     208.3.16278E+06.96935E+05.10309E+06  00000310
      32    13096.0     620.0       0.0     205.8.19627E+06.66715E+05.79389E+05  00000320
      33    21752.6     820.0       0.0     200.0.49106E+06.12567E+06.14651E+06  00000330
      34     7901.5     960.0       0.0     211.9.81383E+05.12   E+06.2    E+06  00000340
      35     9190.7    1043.5       0.0     206.6.87536E+05.14   E+06.2    E+06  00000350
      36     9938.4    1201.1       0.0     222.4.88098E+05.18   E+06.3    E+06  00000360
      37     5702.0    1400.0       0.0     255.8.96249E+05.41788E+05.26039E+05  00000370
      38     6175.2    1570.0       0.0     297.0.21530E+06.10798E+06.15863E+06  00000380
      39     9670.6     801.3     118.3     189.0.15213E+05.13858E+06.36   E+06  00000390
      40    15065.6     852.3     271.8     208.3.19510E+05.12263E+06.3    E+06  00000400
      41     5286.5     943.5     430.7     234.3.72715E+04.52619E+05.11   E+06  00000410
      42     3759.0    1045.8     583.5     272.0.44083E+04.25823E+05.60   E+05  00000420
      43     1542.3    1112.6     740.6     300.4.16708E+04.90137E+04.18   E+05  00000430
      44     5400.0     719.0     321.6     169.3 3651.56    25746.   29374.6    00000440
      45     5151.0     902.8     551.6     212.6 3712.      24588.2   28178.     00000450
      46 NODE POINT DATA : NNP CARDS                                             00000460
      47     1    5     820.0      48.0     181.0                                00000470
      48     1   11     773.9     118.3     187.0                                00000480
      49     2   11     887.0     131.6     180.4                                00000490
      50     1   12     811.8     321.6     204.8                                00000500
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

     51      1   14     994.5     551.6     249.0                                00000510
     52      1   15    1148.0     740.6     306.6                                00000520
     53      1   16     735.7     321.6     203.1                                00000530
     54      1   17     918.4     551.6     249.0                                00000540
     55      1    2     279.0       0.0     146.5                                00000550
     56      2    2    380.         0.      217.9                                00000560
     57      1    3    530.         0.      207.                                 00000570
     58  EXTERNAL SPRING DATA : 2 X NSP CARDS                                    00000580
     59      1    3      74.2      0.50  100000.0                                00000590
     60      2    3      82.1      0.50  100000.0                                00000600
     61      3    3      72.2      0.50  100000.0                                00000610
     62      4    3      70.0      0.50  300000.0                                00000620
     63      5    3      64.2      0.50  300000.0                                00000630
     64      6    3      76.1      0.50  300000.0                                00000640
     65      7    3      69.3      0.50  100000.0                                00000650
     66      8    3      72.6      0.50  100000.0                                00000660
     67      9    3      62.0      0.50  300000.0                                00000670
     68     10    3      82.0      0.40  300000.0                                00000680
     69     16    3      38.3      0.50  272000.                                 00000690
     70     17    3      28.0      0.50  272000.                                 00000700
     71    1.1     1.5       4.0       10.       100000.     5000.    0.00       00000710
     72    1.1     3.3       4.4       18.       200000.     5000.    0.00       00000720
     73    4.0     5.0       6.0       24.0      128000.   128000.    0.00       00000730
     74    1.1     3.3       9.9       10.       200000.   200000.    0.00       00000740
     75    1.1     3.3       9.9       10.       250000.   200000.    0.00       00000750
     76    1.1     3.3       9.9       18.       250000.   200000.    0.00       00000760
     77    4.0     5.0       5.5       24.0       55000.    55000.    0.00       00000770
     78    4.0     5.0       5.5       24.        75000.    75000.    0.00       00000780
     79    1.0     1.1       2.0       3.0       300000.    30000.    0.00       00000790
     80    1.0     1.1       2.0       3.0       300000.    30000.    0.00       00000800
     81   1.      8.0       9.        16.        50000.   100000.                00000810
     82   1.      8.0       9.        16.0       50000.   100000.    0.00       00000820
     83  INTERNAL BEAM DATA : NB CARDS                                           00000830
     84      1    2     32.00      0.00  6.20E+04  3.70E+04      0.00  96.  96. 500000840
     85      2    3     36.00      0.00  7.70E+04  4.30E+04      0.00  99.  99. 500000850
     86      3    4     36.00      0.00  8.64E+04  4.30E+04      0.00  56.  56. 500000860
     87      4    5     59.00      0.00 13.60E+04  4.65E+04      0.00  56.  56. 500000870
     88      5    6     59.00      0.00 11.60E+04  4.65E+04      0.00  66.  66. 500000880
     89      6    7     57.00      0.00 13.60E+04  5.70E+04      0.00  88.  88. 500000890
     90      7    8     48.00      0.00 11.60E+04  6.20E+04      0.00  91.  91. 500000900
     91      8    9     37.00      0.00  5.60E+04  3.35E+04      0.00  51.  51. 500000910
     92      9   10     25.00      0.00  9.00E+04  9.50E+03      0.00  50.  50. 500000920
     93      5 1 11     54.00 4.800E+04  1.59E+04  1.14E+05      0.00  1.0  1.0 500000930
     94   1 11   12     63.20 2.600E+04  1.14E+04  1.02E+05      0.00  1.0  1.0 500000940
     95     12   13      56.3 1.000E+04  4.70E+03  5.80E+04      0.00  1.0  1.0 500000950
     96     13   14      40.7 4.800E+03  2.00E+03  2.10E+04      0.00  1.0  1.0 500000960
     97     14 1 15       20. 2.700E+03  1.20E+03  8.00E+03      0.00  1.0  1.0 500000970
     98   1 12 1 16       8.0 2.208E+02  7.32E+02  1.00E+02      0.00  1.0  1.0 400000980
     99   1 14 1 17       8.0 2.208E+02  7.32E+02  1.00E+02      0.00  1.0  1.0 400000990
    100  BEAM END FIXITY CARDS: NPIN CARDS                                       00001000
    101      1    2    0    0    1    1    0.          0.     1.55          1.55      00001010
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   102       2    3    0    0    1    1    0.         0.    1.65       1.65      00001020
   103       3    4    0    0    1    1    0.         0.    1.15       1.15      00001030
   104       6    7    1    1    0    0    1.6        1.6   0.00       0.00      00001040
   105       7    8    1    1    0    0    1.5        1.5   0.00       0.00      00001050
   106       8    9    1    1    0    0    1.35       1.35  0.00       0.00      00001060
   107   DAMPC CARD                                                               00001070
   108    .100                                                                    00001080
   109   NEG BEAM CUTOFF:NFBMN X 2 CARDS                                          00001090
   110    1 12 1 16    30000.      1.E10     1.E10     1.E10     1.E10     1.E10  00001100
   111    1 14 1 17    30000.      1.E10     1.E10     1.E10     1.E10     1.E10  00001110
   112   LOAD INTERACTION SIGN CONVENTIONS(NSCV CARDS):                           00001120
   113       1    2   -3    4    5    6                                           00001130
   114   LOAD INTERACTION DATA(NLIC+ CARDS):                                      00001140
   115       1    3    5    1    0  300.                           1000.          00001150
   116                             166000.    32.5E+06 -166000.  -32.5E+06        00001160
   117       1    1 215000.   42.5 E+06                                           00001170
   118       2    3    5    1    0  350.                           1000.          00001180
   119                             188000.    39.0E+06 -188000.  -39.0E+06        00001190
   120       1    1 260000.   70.0 E+06                                           00001200
   121       2    3    5    1    0  450.                           1000.          00001210
   122                             210000.    45.0E+06 -210000.  -45.0E+06        00001220
   123       1    1 300000.   100. E+06                                           00001230
   124       3    3    5    1    0  480.                           1000.          00001240
   125                             210000.    50.0E+06 -210000.  -50.0E+06        00001250
   126       1    1 400000.    80. E+06                                           00001260
   127       3    3    5    1    0  540.                           1000.          00001270
   128                             210000.    50.0E+06 -210000.  -50.0E+06        00001280
   129       1    1 400000.   100. E+06                                           00001290
   130       3    3    5    2    0  600.                           1000.          00001300
   131                             280000.    62.5E+06 -280000.  -62.5E+06        00001310
   132       1    1 318000.  206.6 E+06                                           00001320
   133       1    1 422400.   88.7 E+06                                           00001330
   134       4    3    5    2    0  620.                           1000.          00001340
   135                             280000.    62.5E+06 -280000.  -62.5E+06        00001350
   136       1    1 318000.  206.6 E+06                                           00001360
   137       1    1 422400.   88.7 E+06                                           00001370
   138       5    3    5    2    1  960.                           1000.          00001380
   139                             315000.    96.0E+06 -315000.  -96.0E+06        00001390
   140       1    0-5.7617E06  96.5E+06                                           00001400
   141       1    1 521500.   200.8E+06                                           00001410
   142       6    3    5    2    1  960.                           1000.          00001420
   143                             315000.    96.0E+06 -315000.  -96.0E+06        00001430
   144       1    0-5.7617E06  96.5E+06                                           00001440
   145       1    1 521500.   200.8E+06                                           00001450
   146       6    3    5    2    1  990.                           1000.          00001460
   147                             270000.    84.0E+06 -270000.  -84.0E+06        00001470
   148       1    1 301000.   228.7E+06                                           00001480
   149       1    11.3581E 06  84.2E+06                                           00001490
   150       7    3    5    3    1 1090.                           1000.          00001500
   151                             270000.    75.0E+06 -270000.  -75.0E+06        00001510
   152       0    1 210000.  -555.88E06                                           00001520
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

     153     1    1 327700.   107.75E06                                          00001530
     154     1    1 1.5738E06  64.0 E06                                          00001540
     155     7    3    5    3    1     1160.                          1000.     00001550
     156                               270000.     66.0E+06 -270000.  -66.0E+06   00001560
     157     0    1 239000.  -265.64E06                                          00001570
     158     1    1 372214.    85.0E 06                                          00001580
     159     1    1 804840.    50.0E 06                                          00001590
     160     8    3    5    1    1     1210.                          1000.     00001600
     161                               235000.  50.0    E 06 -235000.   -50.0E06   00001610
     162     0    1 200000.  -217.32E06                                          00001620
     163     8    3    5    1    1     1320.                          1000.     00001630
     164                               180000.  40.0    E 06 -180000.   -40.0E06   00001640
     165     0    1 148000.  -91.818E06                                          00001650
     166     8    3    5    2    1     1400.                          1000.     00001660
     167                               160000.  30.0    E+06 -160000.  -30.0E+06   00001670
     168     0    1 125000.  -54.998E06                                          00001680
     169     1    1 260000.    45.0E 06                                          00001690
     170     9    3    5    2    1     1400.                          1000.     00001700
     171                               160000.  30.0    E+06 -160000.  -30.0E+06   00001710
     172     0    1 125000.  -54.998E06                                          00001720
     173     1    1 260000.    45.0E 06                                          00001730
     174 FORCE TIME HISTORY DATA: NACC + CARDS                                   00001740
     175     1    3    2    1                                                    00001750
     176     2    3    2    1                                                    00001760
     177     3    3    2    1                                                    00001770
     178     4    3    2    1                                                    00001780
     179     5    3    2    1                                                    00001790
     180     6    3    2    1                                                    00001800
     181     7    3    2    1                                                    00001810
     182     8    3    2    1                                                    00001820
     183     9    3    2    1                                                    00001830
     184    10    3    2    1                                                    00001840
     185    11    3    2    1                                                    00001850
     186    12    3    2    1                                                    00001860
     187    13    3    2    1                                                    00001870
     188    14    3    2    1                                                    00001880
     189    15    3    2    1                                                    00001890
     190    16    3    2    1                                                    00001900
     191    17    3    2    1                                                    00001910
     192   0.            -95.                                                    00001920
     193   1.            -95.                                                    00001930
     194   0.           -624.5                                                   00001940
     195   1.           -624.5                                                   00001950
     196   0.          -1861.                                                    00001960
     197   1.          -1861.                                                    00001970
     198   0.          -4715.                                                    00001980
     199   1.          -4715.                                                    00001990
     200   0.          -7901.                                                    00002000
     201   1.          -7901.                                                    00002010
     202   0.          -1991.                                                    00002020
     203   1.          -1991.                                                    00002030
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   204      0.         -2316.                                                    00002040
   205      1.         -2316.                                                    00002050
   206      0.         -785.4                                                    00002060
   207      1.         -785.4                                                    00002070
   208      0.          -450.                                                    00002080
   209      1.         -450.0                                                    00002090
   210      0.        17445.6                                                    00002100
   211      1.        17445.6                                                    00002110
   212      0.       -23129.2                                                    00002120
   213      1.       -23129.2                                                    00002130
   214      0.       -28188.2                                                    00002140
   215      1.       -28188.2                                                    00002150
   216      0.       -21394.1                                                    00002160
   217      1.       -21394.1                                                    00002170
   218      0.       -17818.8                                                    00002180
   219      1.       -17818.8                                                    00002190
   220      0.        -6240.9                                                    00002200
   221      1.        -6240.9                                                    00002210
   222      0.         -270.8                                                    00002220
   223      1.         -270.8                                                    00002230
   224      0.         -258.3                                                    00002240
   225      1.         -258.3                                                    00002250
   226   MASS PLOT PARAMETERS: NMEP                                              00002260
   227       1    1    0    0    0    0    1    1    0    1                      00002270
   228       2    1    0    0    0    0    1    1    0    1                      00002280
   229       3    1    0    0    0    0    1    1    0    1                      00002290
   230       4    1    0    0    0    0    1    1    0    1                      00002300
   231       5    1    1    1    1    1    1    1    1    1                      00002310
   232       6    1    0    0    0    0    1    1    0    1                      00002320
   233       7    1    0    0    0    0    1    1    0    1                      00002330
   234       8    1    0    0    0    0    1    1    0    1                      00002340
   235       9    1    0    0    0    0    1    1    0    1                      00002350
   236      16    1         0    0         0    1         1                      00002360
   237      17    1         0    0         0    1         1                      00002370
   238   BEAM ELEMENT LOAD PLOT PARAMETERS:NBFP PLOTS                            00002380
   239       1    1    1    1                                                    00002390
   240       2    1    1    1                                                    00002400
   241       3    1    1    1                                                    00002410
   242       4    1    1    1                                                    00002420
   243       5    1    1    1                                                    00002430
   244       6    1    1    1                                                    00002440
   245       7    1    1    1                                                    00002450
   246       8    1    1    1                                                    00002460
   247       9    1    1    1                                                    00002470
   248      10    1    1    1                                                    00002480
   249      11    1    1    1                                                    00002490
   250      12    1    1    1                                                    00002500
   251      13    1    1    1                                                    00002510
   252      14    1    1    1                                                    00002520
   253      15    1    1    1                                                    00002530
   254      16    1    1    1                                                    00002540
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ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                   1         2         3         4         5         6         7         8
CARD NO.  12345678901234567890123456789012345678901234567890123456789012345678901234567890

     255  BEAM ELEMENT DEFLECTION PLOT PARAMETERS: NBDP                         00002550
     256      1    1    1    1                                                  00002560
     257      2    1    1    1                                                  00002570
     258      3    1    1    1                                                  00002580
     259      4    1    1    1                                                  00002590
     260      5    1    1    1                                                  00002600
     261      6    1    1    1                                                  00002610
     262      7    1    1    1                                                  00002620
     263      8    1    1    1                                                  00002630
     264      9    1    0    1                                                  00002640
     265     10    1    1    1                                                  00002650
     266     11    1    1    1                                                  00002660
     267     12    1    1    1                                                  00002670
     268     13    1    1    1                                                  00002680
     269     14    1    1    1                                                  00002690
     270     15    1    0    1                                                  00002700
     271     16    1    0    1                                                  00002710
     272  EXTERNAL SPRING LOAD-DEFLECTION PLOT PARAMETERS: NSEP                 00002720
     273      2    0    1    1                                                  00002730
     274      3    0    1    1                                                  00002740
     275      4    0    1    1                                                  00002750
     276      5    0    1    1                                                  00002780
     277      6    0    1    1                                                  00002790
     278      7    0    1    1                                                  00002800
     279      8         1    1                                                  00002810
     280     16    0    1    1                                                  00002820
     281     17         1    1                                                  00002830
     282  END                                                                   00002840
```

A.4 KRASH CID AIRPLANE EXPANDED MODEL ECHO

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                   1         2         3         4         5         6         7         8
CARD NO.  12345678901234567890123456789012345678901234567890123456789012345678901234567890

      1   GILS.PRECID.OLDENG44.DATA   6-25-85 193K WT FWD FUS&WING&ENG T=.16        00000010
      2   155 KTS.+1. PITCH 00 YAW 00 ROLL 17 ROD-RIG.GRD MU=.50 .DIAGS. NLB=44     00000020
      3   1234567890123456789012345678901234567890123456789012345678901234567890120000000030
      4      NM   NSP    NB   NLB   NNP NPIN   NUB NDRINOLEO NACC   MVP NVCH NMTL    ND 00000040
      5      48    18   137    44    34   66    48    0     0   48     0    0    0     0 00000050
      6    NVBM NFBMNVBMNNFBMN   NKM   NHI   NPH TOL1 TOL2 TOL3  NSC  NICNAERONBOMB  00000060
      7       0    12     0    31     0    0     0 1000 1000 1000    0    1    0     1 00000070
      8    NSCV NLICNWRGR NBAL   ICDICITR                                          00000080
      9       1    18     0     5     1    1                                        00000090
     10   GRAPHICS                                                                  00000100
     11                                                                             00000110
     12                                                                        25   00000120
     13   ONE RESTART AND ONE SAVE CARD FOLLOWS                                     00000130
     14                                                                             00000140
     15                                                                             00000150
     16        IPRINT  DELTAT    TMAX      PLOWT      FCUT       RUNMOD             00000160
     17            50 .000100   0.160     0.000      50.         1.                00000170
     18   BLANK CARD FOLLOWS                                                        00000180
     19                                                                             00000190
     20     NSF   NTF   NDE NSPD   NED    NS   NRP NIMP   NBC : PRINT DATA          00000200
     21       0     0     0    0     0     0     0    0     0                       00000210
     22    NMEP NNEP NBFP NBDP NSTP NSEP NENP NDRP NPLTNPFCT : PLOT DATA           00000220
     23      20     0     0    0     0     0     0    0    0    0                  00000230
     24   INITIAL CONDITION DATA : 3 CARDS                                          00000240
     25      3140.00    000.00    204.00                                            00000250
     26       000.00    000.00    000.00                                            00000260
     27       000.00   +.01730    000.00     000.00     000.00       0.001.1463E-07 00000270
     28   MASS DATA : NM CARDS                                                      00000280
     29        525.6     199.0       0.0      205.0.37996E+[illegible].13200E+04.49500E+03 00000290
     30       4476.0     300.0       0.0      205.0.29396E+04.99000E+04.32670E+04   00000300
     31       6418.0     460.0       0.0      205.0.53717E+04.31989E+04.34020E+04   00000310
     32       5745.0     620.0       0.0      205.0.64769E+04.22016E+04.26198E+04   00000320
     33       9438.0     820.0       0.0      205.0.16205E+05.41471E+04.48348E+04   00000330
     34       3585.0     960.0       0.0      205.0.26856E+04.39600E+04.66000E+04   00000340
     35       3759.0    1040.0       0.0      205.0.28887E+04.46200E+04.66000E+04   00000350
     36       4083.0    1200.0       0.0      205.0.29072E+04.59400E+04.99000E+04   00000360
     37       2505.0    1400.0       0.0      205.0.31762E+04.13790E+04.85929E+03   00000370
     38       6175.0    1570.0       0.0      297.0.21530E+06.10798E+06.15863E+06   00000380
     39        277.5     199.0      46.0      205.0.51468E+03.17880E+04.67050E+03   00000390
     40       2238.0     300.0      66.0      205.0.39819E+04.13410E+05.44253E+04   00000400
     41       3352.0     460.0      70.0      205.0.72763E+04.43330E+04.46081E+04   00000410
     42       2994.0     620.0      70.0      205.0.87733E+04.29822E+04.35487E+04   00000420
     43       4920.0     820.0      70.0      205.0.21950E+05.56174E+04.65490E+04   00000430
     44       1864.0     960.0      70.0      205.0.36378E+04.53640E+04.89400E+04   00000440
     45       1968.0    1040.0      70.0      205.0.39129E+04.62580E+04.89400E+04   00000450
     46       2133.0    1200.0      70.0      205.0.39380E+04.80460E+04.13410E+05   00000460
     47       1307.0    1400.0      46.0      205.0.43023E+04.18679E+04.11639E+04   00000470
     48        430.0     460.0      70.0      181.0.36516E+04.25746E+05.29375E+05   00000480
     49         65.0     199.0      40.0      240.0.47207E+03.16400E+04.61500E+03   00000490
     50        410.0     300.0      65.0      264.0.36523E+04.12300E+04.40590E+04   00000500
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                   1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   51       594.0     460.0      65.0    270.0.66740E+04.39743E+04.42267E+04  00000510
   52       505.0     620.0      65.0    270.0.80471E+04.27353E+04.32549E+04  00000520
   53       837.0     820.0      65.0    270.0.20133E+05.51525E+04.60069E+04  00000530
   54       305.0     960.0      65.0    270.0.33367E+04.49200E+04.82000E+04  00000540
   55       356.0    1040.0      65.0    270.0.35890E+04.57400E+04.82000E+04  00000550
   56       383.0    1200.0      65.0    270.0.36120E+04.73800E+04.12300E+05  00000560
   57       221.0    1400.0      40.0    240.0.39462E+04.17133E+04.10676E+04  00000570
   58       260.0    1040.0      70.0    181.0.36516E+04.25746E+05.29375E+05  00000580
   59        48.0     199.0       0.0    270.0.34887E+03.12120E+04.45450E+03  00000590
   60       304.0     300.0       0.0    280.0.26991E+04.90900E+04.29997E+04  00000600
   61       440.0     460.0       0.0    293.0.49322E+04.29371E+04.31236E+04  00000610
   62       374.0     620.0       0.0    293.0.59470E+04.20215E+04.24055E+04  00000620
   63       620.0     820.0       0.0    293.0.14879E+05.38078E+04.44392E+04  00000630
   64       226.0     960.0       0.0    293.0.24659E+04.36360E+04.60600E+04  00000640
   65       264.0    1040.0       0.0    293.0.26523E+04.42420E+04.60600E+04  00000650
   66       284.0    1200.0       0.0    293.0.26694E+04.54540E+04.90900E+04  00000660
   67       164.0    1400.0       0.0    280.0.29163E+04.12662E+04.78898E+03  00000670
   68       277.0    1200.0      70.0    181.0.36520E+04.25788E+05.29478E+05  00000680
   69      9786.0     801.3     118.3    188.3.07642E+05.69387E+05.18000E+06  00000690
   70      4835.0     825.3     176.8    195.7.07642E+05.69387E+05.18000E+06  00000700
   71     10065.0     852.3     271.8    203.1.19542E+06.12387E+06.30000E+06  00000710
   72      5286.0     943.5     430.7    219.9.72715E+04.52619E+05.11000E+06  00000720
   73      3759.0    1045.8     583.5    243.5.44083E+04.25823E+05.60000E+05  00000730
   74      1542.0    1112.6     740.6    255.0.16708E+04.90137E+04.18000E+05  00000740
   75      5400.0     719.0     321.6    169.3.36516E+04.25746E+05.29375E+05  00000750
   76      5151.      902.8     551.6    188.1.37120E+04.24588E+05.28178E+05  00000760
   77  NODE POINT DATA : NNP CARDS                                            00000770
   78       1   14    620.       70.     181.                                 00000780
   79       1   16    960.       70.     181.                                 00000790
   80       1   12    300.       66.     181.                                 00000800
   81       1   15    820.       70.     181.                                 00000810
   82       1   41    650.0     118.3    205.                                 00000820
   83       2   41    833.0     118.3    205.                                 00000830
   84       3   41    650.      118.3    171.6                                00000840
   85       4   41    833.      118.3    171.6                                00000850
   86       1   42    770.0     176.8    195.7                                00000860
   87       2   42    900.0     176.8    195.7                                00000870
   88       1   43    790.0     271.8    203.1                                00000880
   89       2   43    919.0     271.8    203.1                                00000890
   90       1   44    893.0     430.7    219.9                                00000900
   91       2   44    993.0     430.7    219.9                                00000910
   92       1   45   1010.0     583.5    243.5                                00000920
   93       2   45   1080.0     583.5    243.5                                00000930
   94       1   46   1087.0     740.0    255.0                                00000940
   95       2   46   1137.0     740.0    255.0                                00000950
   96       1   47    735.7     321.6    199.6                                00000960
   97       1   48    918.4     551.6    220.5                                00000970
   98       1    2    300.0       0.0    205.0                                00000980
   99       2    2    279.0       0.0    147.5                                00000990
  100       1    1    199.0       0.0    205.0                                00001000
  101       1   11    199.       46.0    205.                                 00001010
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                   1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   102        2    1      199.        0.0      150.                                00001020
   103        3    2      300.        0.0      150.                                00001030
   104        1    3      460.        0.0      150.                                00001040
   105        1    4      620.        0.0      140.                                00001050
   106        1    5      820.        0.0      140.                                00001060
   107        1    6      960.        0.0      140.                                00001070
   108        1    7     1040.0       0.0      150.                                00001080
   109        1    8     1200.        0.0      150.                                00001090
   110        1    9     1400.        0.0      150.                                00001100
   111        2    9     1400.        0.0      253.1                               00001110
   112   EXTERNAL SPRING DATA : 2 X NSP CARDS                                      00001120
   113        1    3       60.2      0.35  100000.0                                00001130
   114        2    3       69.2      0.35  100000.0                                00001140
   115       20    3       44.2      0.35  100000.0                                00001150
   116        4    3       68.2      0.35  300000.0                                00001160
   117        5    3       69.4      0.35  300000.0                                00001170
   118        6    3       69.1      0.35  300000.0                                00001180
   119       30    3       42.7      0.35  100000.0                                00001190
   120       40    3       32.2      0.35  100000.0                                00001200
   121        9    3       13.0      0.35  300000.0                                00001210
   122       10    3       82.0      0.35  300000.0                                00001220
   123       12    3       69.2      0.35  100000.                                 00001230
   124       14    3       68.2      0.35  100000.                                 00001240
   125       15    3       69.4      0.35  100000.                                 00001250
   126       16    3       69.1      0.35  100000.                                 00001260
   127       42    3       14.0      0.35  100000.0                                00001270
   128       41    3       28.0      0.35  100000.0                                00001280
   129       47    3       38.3      0.35  272000.0                                00001290
   130       48    3       28.0      0.35  272000.0                                00001300
   131      1.1     1.5        4.0       10.        50000.     2500.    0.00        00001310
   132      1.1     3.3        4.4       18.0      100000.     2500.    0.00        00001320
   133      4.0     5.0        6.0       24.0       64000.    64000.    0.00        00001330
   134      1.1     3.3        6.6       10.       100000.   100000.    0.00        00001340
   135      1.1     3.3        6.6       10.       125000.   100000.    0.00        00001350
   136      1.1     3.3        6.6       18.       125000.   100000.    0.00        00001360
   137      4.0     5.0        6.0       18.0       27500.    27500.    0.00        00001370
   138      4.0     5.0        6.0       18.0       37500.    37500.    0.00        00001380
   139      1.0     1.1        2.0       3.0       150000.    15000.    0.00        00001390
   140      1.0     1.1        2.0       3.0       150000.    15000.    0.00        00001400
   141      1.1     3.3        4.4       18.        50000.     1250.                00001410
   142      1.1     3.3        6.6       10.        50000.    50000.                00001420
   143      1.1     3.3        6.6       10.        62500.    50000.                00001430
   144      1.1     3.3        6.6       18.        62500.    50000.                00001440
   145      1.      1.5        2.        7.        330000.   330000.                00001450
   146      1.      1.5        2.        7.        330000.   330000.    0.00        00001460
   147      1.      8.         9.        16.        50000.   100000.                00001470
   148      1.      8.         9.        16.        50000.   100000.                00001480
   149   INTERNAL BEAM DATA : NB CARDS                                             00001490
   150        1   11       4.35     840.0     53.00     1000.0         3    1    1 500001500
   151        2   12       6.30    1200.0     74.00     2400.0         3    1    1 500001510
   152        3   13       7.20    1380.0     84.00     4000.0         3    1    1 500001520
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

CARD NO.										
153	4	14	8.10	1560.0	95.00	6000.0	3	1	1	500001530
154	5	15	8.10	1560.0	95.00	6000.0	3	1	1	500001540
155	6	16	5.40	1018.0	64.00	1500.0	3	1	1	500001550
156	7	17	5.40	1018.0	64.00	1500.0	3	1	1	500001560
157	8	18	8.10	1560.0	95.00	6000.0	3	1	1	500001570
158	9	19	4.50	840.0	53.00	1000.0	3	1	1	500001580
159	11	21	6.60	250.0	400.0	9.0	1.8	1.8	1	500001590
160	21	31	6.60	250.0	9.00	400.0	1.8	1.8	1	500001600
161	12	22	8.75	334.0	1000.0	12.6	1.8	1.8	1	500001610
162	22	32	8.75	334.0	12.60	1000.0	1.8	1.8	1	500001620
163	13	23	10.0	383.0	1600.	14.4	1.8	1.8	1	500001630
164	23	33	10.0	383.0	14.40	1600.0	1.8	1.8	1	500001640
165	14	24	11.3	432.0	2400.	16.2	1.8	1.8	1	500001650
166	24	34	11.3	432.0	16.20	2400.0	1.8	1.8	1	500001660
167	15	25	11.3	432.0	2400.	16.2	1.8	1.8	1	500001670
168	25	35	11.3	432.0	16.20	2400.0	1.8	1.8	1	500001680
169	16	26	7.50	285.0	600.	10.8	1.8	1.8	1	500001690
170	26	36	7.50	285.0	10.80	600.0	1.8	1.8	1	500001700
171	17	27	7.50	285.0	600.0	10.8	1.8	1.8	1	500001710
172	27	37	7.50	285.0	10.80	600.0	1.8	1.8	1	500001720
173	18	28	11.2	432.0	2000.	16.2	1.8	1.8	1	500001730
174	28	38	11.2	432.0	16.20	2000.0	1.8	1.8	1	500001740
175	19	29	6.30	250.0	400.	9.0	1.8	1.8	1	500001750
176	29	39	6.30	250.0	9.00	400.0	1.8	1.8	1	500001760
177	13	20	10.0	383.0	1600.0	14.4	1.8	1.8	1	500001770
178	17	30	7.50	285.0	600.0	10.8	1.8	1.8	1	500001780
179	18	40	11.2	432.0	2000.0	16.2	1	1	1	500001790
180	21	22	3.10	0.0	982.00	20.00	1	1	1	500001800
181	22	23	3.86	0.0	1228.00	24.70	1	1	1	500001810
182	23	24	5.53	0.0	1763.00	35.50	1	1	1	500001820
183	24	25	5.53	0.0	1763.00	35.50	1	1	1	500001830
184	25	26	5.55	0.0	1763.00	35.50	1	1	1	500001840
185	26	27	5.18	0.0	1650.00	33.20	1	1	1	500001850
186	27	28	4.23	0.0	592.00	11.90	1	1	1	500001860
187	28	29	3.10	0.0	434.00	8.70	1	1	1	500001870
188	31	32	8.02	0.0	874.00	11092.0	1	1	1	500001880
189	32	33	10.1	0.0	1012.00	13865.0	1	1	1	500001890
190	33	34	12.86	0.0	1307.00	17616.0	1	1	1	500001900
191	34	35	12.86	0.0	1307.00	17616.0	1	1	1	500001910
192	35	36	14.02	0.0	1511.00	19616.0	1	1	1	500001920
193	36	37	12.75	0.0	1375.00	17462.0	1	1	1	500001930
194	37	38	12.00	0.0	1296.00	16453.0	1	1	1	500001940
195	38	39	10.32	0.0	1116.00	14172.0	1	1	1	500001950
196	1	2	2.32	500.	8.25	1000.00	4	1	1	500001960
197	2	3	2.54	750.	8.25	4000.00	4	1	1	500001970
198	3	4	2.54	800.	8.25	4000.00	4	1	1	500001980
199	4	5	4.35	800.	16.50	8000.00	4	1	1	500001990
200	5	6	4.35	800.	16.50	8000.00	4	1	1	500002000
201	6	7	4.00	800.	16.50	8000.00	4	1	1	500002010
202	7	8	3.40	700.	12.75	6000.00	4	1	1	500002020
203	8	9	2.54	500.	8.25	4000.00	4	1	1	500002030

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

  204       11   12      2.20      100.     11.80    500.00         4    1    1 500002040
  205       12   13      1.40      100.      8.20    347.00         4    1    1 500002050
  206       13   14      1.28      100.      5.90    243.00         4    1    1 500002060
  207       14   15      1.28      200.      5.90    243.00         4    1    1 500002070
  208       15   16      2.84      200.     12.70    535.00         4    1    1 500002080
  209       16   17      3.00      200.     16.30    687.00         4    1    1 500002090
  210       17   18      1.45      100.      8.30    351.00         4    1    1 500002100
  211       18   19      1.36      100.      5.90    250.00         4    1    1 500002110
  212     2  9   10     25.00       0.0    1.4E05    1.4E04         1    1    1 500002120
  213     1 12   20      0.76       0.0      6.50      6.60         1    1    1 500002130
  214     1 14   20      0.63       0.0      5.40      6.30         1    1    1 500002140
  215     1 16   30       .49       0.0      4.20      6.00         1    1    1 500002150
  216       30   40       .67       0.0      5.70      6.40         1    1    1 500002160
  217       19   40       .33       0.0      2.85      3.20         1    1    1 500002170
  218     2 43 1 47      2.00      55.5    183.00     25.00         1    1    1 400002180
  219     2 45 1 48      2.00      55.4    183.00     25.00         1    1    1 400002190
  220       15 2 41     13.50    1.2E04   3200.00    .29E04         1    1    1 500002200
  221       14 1 41     13.50    1.2E04   3200.00    .29E04         1    1    1 500002210
  222     3 41    0     13.5     1.2E04   3200.00    .29E04         1    1    1 500002220
  223     4 41    0     13.5     1.2E04   3200.00    .29E04         1    1    1 500002230
  224     1 43   47      2.00      55.4    183.00     25.00         1    1    1 400002240
  225     1 45   48      2.00      55.4    183.00     25.00         1    1    1 400002250
  226       41   42     63.20   26000.0  11400.00 102000.00         1    1    1 500002260
  227       42   43     60.00   18000.0   8100.00  80000.00         1    1    1 500002270
  228       43   44     56.00   10000.0   4700.00  58000.00         1    1    1 500002280
  229       44   45     40.70    4800.0   2000.00  21000.00         1    1    1 500002290
  230       45   46     20.00    2700.0   1200.00   8000.00         1    1    1 500002300
  231     2  1 3  2     4.5        100.     592.      6985.         1    1    1 500002310
  232     3  2 1  3      5.54       100.    700.      82[illegible].         1    1    1 500002320
  233     1  3 1  4      3.84      100.     500.       15.6         1    1    1 500002330
  234     1  4 1  5      3.84      100.     500.       15.6         1    1    1 500002340
  235     1  5 1  6     6.0        100.     800.      26.           1    1    1 500002350
  236     1  6 1  7     9.3        100.    1120.00    13200.        1    1    1 500002360
  237     1  7 1  8     6.6        100.     840.       9920.        1    1    1 500002370
  238     1  8 1  9     5.4        100.     629.       7425.        1    1    1 500002380
  239        2 1 12     4.5                                                      400002390
  240        4 1 14     5.6                                                      400002400
  241        5 1 15     7.2                                                      400002410
  242        6 1 16     4.4                                                      400002420
  243     1 16   17     5.0                                                      400002430
  244       16   30     5.0                                                      400002440
  245       17   40     5.                                                       400002450
  246       18   30     5.                                                       400002460
  247       12   20     5.                                                       400002470
  248     1 12   13     5.                                                       400002480
  249       14   20     5.                                                       400002490
  250       13 1 14     5.                                                       400002500
  251       12   23     5.                                                       400002510
  252       13   22     5.                                                       400002520
  253       13   24     5.                                                       400002530
  254       14   23     5.                                                       400002540
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ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

     255    14   25    5.                                                       400002550
     256    15   24    5.                                                       400002560
     257    15   26    5.                                                       400002570
     258    16   25    5.                                                       400002580
     259    16   27    5.0                                                      400002590
     260    17   26    5.0                                                      400002600
     261    17   28    5.                                                       400002610
     262    18   27    5.                                                       400002620
     263    18   29    5.                                                       400002630
     264    19   28    5.                                                       400002640
     265    22   33    5.                                                       400002650
     266    23   32    5.                                                       400002660
     267    23   34    5.                                                       400002670
     268    24   33    5.                                                       400002680
     269    24   35    5.                                                       400002690
     270    25   34    5.                                                       400002700
     271    25   36    5.                                                       400002710
     272    26   35    5.                                                       400002720
     273    26   37    5.0                                                      400002730
     274    27   36    5.0                                                      400002740
     275    27   38    5.                                                       400002750
     276    28   37    5.                                                       400002760
     277    28   39    5.                                                       400002770
     278    29   38    5.                                                       400002780
     279  1  5   15    7.2                                                      400002790
     280  1  4   14    5.6                                                      400002800
     281  1  6   16    4.4                                                      400002810
     282  1  4    5    4.                                                       400002820
     283     4 1  5    4.                                                       400002830
     284  1  5    6    4.                                                       400002840
     285     5 1  6    4.                                                       400002850
     286  3  2   12    4.                                                       400002860
     287 BEAM END FIXITY CARDS: NPIN CARDS                                       00002870
     288    21   31    0    0    1    0    0.         0.    1.0        0.0       00002880
     289    22   32    0    0    1    0    0.         0.    1.0        0.0       00002890
     290    23   33    0    0    1    0    0.         0.    1.0        0.0       00002900
     291    24   34    0    0    1    0    0.         0.    1.0        0.0       00002910
     292    25   35    0    0    1    0    0.         0.    1.0        0.0       00002920
     293    26   36    0    0    1    0    0.         0.    1.0        0.0       00002930
     294    27   37    0    0    1    0    0.         0.    1.0        0.0       00002940
     295    28   38    0    0    1    0    0.         0.    1.0        0.0       00002950
     296    29   39    0    0    1    0    0.         0.    1.0        0.0       00002960
     297    11   21    0    1    0    1    0.         1.    0.0        1.0       00002970
     298    12   22    0    1    0    1    0.         1.    0.0        1.0       00002980
     299    13   23    0    1    0    1    0.         1.    0.0        1.0       00002990
     300    14   24    0    1    0    1    0.         1.    0.0        1.0       00003000
     301    15   25    0    1    0    1    0.         1.    0.0        1.0       00003010
     302    16   26    0    1    0    1    0.         1.    0.0        1.0       00003020
     303    17   27    0    1    0    1    0.         1.    0.0        1.0       00003030
     304    18   28    0    1    0    1    0.         1.    0.0        1.0       00003040
     305    19   29    0    1    0    1    0.         1.    0.0        1.0       00003050
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ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   306       2 1 12    1    1    1    1                                          00003060
   307       4 1 14    1    1    1    1                                          00003070
   308       5 1 15    1    1    1    1                                          00003080
   309       6 1 16    1    1    1    1                                          00003090
   310    1  4    5    1    1    1    1                                          00003100
   311       4 1  5    1    1    1    1                                          00003110
   312    1  5    6    1    1    1    1                                          00003120
   313       5 1  6    1    1    1    1                                          00003130
   314    3  2   12    1    1    1    1                                          00003140
   315    1  6   16    1    1    1    1                                          00003150
   316    1  5   15    1    1    1    1                                          00003160
   317    1  4   14    1    1    1    1                                          00003170
   318    1 16   17    1    1    1    1                                          00003180
   319      16   30    1    1    1    1                                          00003190
   320      17   40    1    1    1    1                                          00003200
   321      18   30    1    1    1    1                                          00003210
   322      12   20    1    1    1    1                                          00003220
   323    1 12   13    1    1    1    1                                          00003230
   324      14   20    1    1    1    1                                          00003240
   325      13 1 14    1    1    1    1                                          00003250
   326      12   23    1    1    1    1                                          00003260
   327      13   22    1    1    1    1                                          00003270
   328      13   24    1    1    1    1                                          00003280
   329      14   23    1    1    1    1                                          00003290
   330      14   25    1    1    1    1                                          00003300
   331      15   24    1    1    1    1                                          00003310
   332      15   26    1    1    1    1                                          00003320
   333      16   25    1    1    1    1                                          00003330
   334      16   27    1    1    1    1                                          00003340
   335      17   26    1    1    1    1                                          00003350
   336      17   28    1    1    1    1                                          00003360
   337      18   27    1    1    1    1                                          00003370
   338      18   29    1    1    1    1                                          00003380
   339      19   28    1    1    1    1                                          00003390
   340      22   33    1    1    1    1                                          00003400
   341      23   32    1    1    1    1                                          00003410
   342      23   34    1    1    1    1                                          00003420
   343      24   33    1    1    1    1                                          00003430
   344      24   35    1    1    1    1                                          00003440
   345      25   34    1    1    1    1                                          00003450
   346      25   36    1    1    1    1                                          00003460
   347      26   35    1    1    1    1                                          00003470
   348      26   37    1    1    1    1                                          00003480
   349      27   36    1    1    1    1                                          00003490
   350      27   38    1    1    1    1                                          00003500
   351      28   37    1    1    1    1                                          00003510
   352      28   39    1    1    1    1                                          00003520
   353      29   38    1    1    1    1                                          00003530
   354   UNSYM.BEAM ELEMENTS;NUB CARDS                                           00003540
   355       2 1 12    1                                                         00003550
   356       4 1 14    1                                                         00003560
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ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                    1         2         3         4         5         6         7         8
CARD NO.   12345678901234567890123456789012345678901234567890123456789012345678901234567890

   357         5 1 15    1                                                         00003570
   358         6 1 16    1                                                         00003580
   359      1 16   17    1                                                         00003590
   360        16   30    1                                                         00003600
   361        17   40    1                                                         00003610
   362        18   30    1                                                         00003620
   363        12   20    1                                                         00003630
   364      1 12   13    1                                                         00003640
   365        14   20    1                                                         00003650
   366        13 1 14    1                                                         00003660
   367        12   23    1                                                         00003670
   368        13   22    1                                                         00003680
   369        13   24    1                                                         00003690
   370        14   23    1                                                         00003700
   371        14   25    1                                                         00003710
   372        15   24    1                                                         00003720
   373        15   26    1                                                         00003730
   374        16   25    1                                                         00003740
   375        16   27    1                                                         00003750
   376        17   26    1                                                         00003760
   377        17   28    1                                                         00003770
   378        18   27    1                                                         00003780
   379      1  5   15    1                                                         00003790
   380      1  4   14    1                                                         00003800
   381      1  6   16    1                                                         00003810
   382      1  4    5    1                                                         00003820
   383         4 1  5    1                                                         00003830
   384      1  5    6    1                                                         00003840
   385         5 1  6    1                                                         00003850
   386      3  2   12    1                                                         00003860
   387        18   29    1                                                         00003870
   388        19   28    1                                                         00003880
   389        22   33    1                                                         00003890
   390        23   32    1                                                         00003900
   391        23   34    1                                                         00003910
   392        24   33    1                                                         00003920
   393        24   35    1                                                         00003930
   394        25   34    1                                                         00003940
   395        25   36    1                                                         00003950
   396        26   35    1                                                         00003960
   397        26   37    1                                                         00003970
   398        27   36    1                                                         00003980
   399        27   38    1                                                         00003990
   400        28   37    1                                                         00004000
   401        28   39    1                                                         00004010
   402        29   38    1                                                         00004020
   403     DAMPC CARD                                                              00004030
   404      .10                                                                    00004040
   405     NONLINEAR BEAMS:NLB CARDS                                               00004050
   406        21   22    1    5   .32                                              00004060
   407        22   23    1    5   .48                                              00004070
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                    1         2         3         4         5         6         7         8
CARD NO.   12345678901234567890123456789012345678901234567890123456789012345678901234567890

    408      23   24    1    5   .48                                                00004080
    409      24   25    1    5   .6                                                 00004090
    410      25   26    1    5   .4                                                 00004100
    411      26   27    1    5   .24                                                00004110
    412      27   28    1    5   .48                                                00004120
    413      31   32    1    8   .39                                                00004130
    414      32   33    1    8   .59                                                00004140
    415      33   34    1    8   .59                                                00004150
    416      34   35    1    8   .75                                                00004160
    417      35   36    1    8   .52                                                00004170
    418      36   37    1    8   .3                                                 00004180
    419      37   38    1    8   .59                                                00004190
    420       1    2    1    5   .32                                                00004200
    421       2    3    1    5   .48                                                00004210
    422       3    4    1    5   .48                                                00004220
    423       4    5    1    5   .60                                                00004230
    424       5    6    1    5   .40                                                00004240
    425       6    7    1    5   .24                                                00004250
    426       7    8    1    5   .48                                                00004260
    427      11   12    1    5   .32                                                00004270
    428      12   13    1    5   .48                                                00004280
    429      13   14    1    5   .48                                                00004290
    430      14   15    1    5   .60                                                00004300
    431      15   16    1    5   .40                                                00004310
    432      16   17    1    5   .24                                                00004320
    433      17   18    1    5   .48                                                00004330
    434    1 12   20    1    5   .48                                                00004340
    435    1 14   20    1    5   .48                                                00004350
    436    1 16   30    1    5   .24                                                00004360
    437      30   40    1    5   .48                                                00004370
    438      19   40    1    5   .6                                                 00004380
    439    2  1 3  2    1    5   .32                                                00004390
    440    3  2 1  3    1    5   .48                                                00004400
    441    1  3 1  4    1    5   .48                                                00004410
    442    1  4 1  5    1    5   .60                                                00004420
    443    1  5 1  6    1    5   .4                                                 00004430
    444    1  6 1  7    1    5   .24                                                00004440
    445    1  7 1  8    1    5   .48                                                00004450
    446    1  8 1  9    1    5   .48                                                00004460
    447       6   16    1    5   .2                                                 00004470
    448       7   17    1    5   .2                                                 00004480
    449       8   18    1    5   .2                                                 00004490
    450    POS BEAM CUTOFF: NFBM X 2 CARDS                                          00004500
    451       2   12     2.10E5    7.2E04     7.2E04     1.E10     1.E10     1.E10    00004510
    452       3   13     2.44E5    8.2E04     8.2E04     1.E10     1.E10     1.E10    00004520
    453       4   14     2.75E5    9.2E04     9.2E04     1.E10     1.E10     1.E10    00004530
    454       5   15     2.75E5    9.2E04     9.2E04     1.E10     1.E10     1.E10    00004540
    455       6   16     1.80E5    6.2E04     6.2E04     1.E10     1.E10     1.E10    00004550
    456       7   17     1.83E5    6.2E04     6.2E04     1.E10     1.E10     1.E10    00004560
    457    2  9   10     8.50E5    1.0E10     1.5E05     1.E10     2.E07     1.E10    00004570
    458    1  3 1  4     134000    1.0E10     4.3E04     1.E10     1.E10     1.E10    00004580
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                      1         2         3         4         5         6         7         8
CARD NO.  12345678901234567890123456789012345678901234567890123456789012345678901234567890

  459        15 2 41     4.60E5    1.5E05    1.5E05     1.E10     1.E10     1.E10  00004590
  460        14 1 41     4.60E5    1.5E05    1.5E05     1.E10     1.E10     1.E10  00004600
  461     3 41     0     4.60E5    1.5E05    1.5E05     1.E10     1.E10     1.E10  00004610
  462     4 41     0     4.60E5    1.5E05    1.5E05     1.E10     1.E10     1.E10  00004620
  463     NEG BEAM CUTOFF:NFBMN X 2 CARDS                                          00004630
  464     2 43 1 47      30000.     1.E10    1.25E5     1.E10     1.E10     1.E10  00004640
  465     1 43   47      30000.     1.E10    1.25E5     1.E10     1.E10     1.E10  00004650
  466     2 45 1 48      30000.     1.E10    1.25E5     1.E10     1.E10     1.E10  00004660
  467     1 45   48      30000.     1.E10    1.25E5     1.E10     1.E10     1.E10  00004670
  468     1  3 1  4     134000.     1.E10     4.3E4     1.E10     1.E10     1.E10  00004680
  469     1  4 1  5     134000.     1.E10     4.3E4     1.E10     1.E10     1.E10  00004690
  470     1  5 1  6     210000.     1.E10     6.8E4     1.E10     1.E10     1.E10  00004700
  471     1  6 1  7     265000.     1.E10     1.1E5     1.E10     1.E10     1.E10  00004710
  472     1  7 1  8     231000.     1.E10     7.1E4     1.E10     1.E10     1.E10  00004720
  473     1  8 1  9     183000.     6.2E4     6.2E4     1.E10     1.E10     1.E10  00004730
  474     2  9   10       8.5E5     1.E10     1.5E5     1.E10     2.E07     1.E10  00004740
  475        3    4       1.2E5     1.E10     2.9E4     1.E10     1.E10     1.E10  00004750
  476        4    5       1.5E5     1.E10     4.9E4     1.E10     1.E10     1.E10  00004760
  477        5    6       1.5E5     1.E10     4.9E4     1.E10     1.E10     1.E10  00004770
  478        6    7       1.4E5     1.E10     4.5E4     1.E10     1.E10     1.E10  00004780
  479        7    8       1.2E5     1.E10     3.9E4     1.E10     1.E10     1.E10  00004790
  480       13   14       4.0E4     1.E10     1.5E4     1.E10     1.E10     1.E10  00004800
  481       14   15       4.4E4     1.E10     1.5E4     1.E10     1.E10     1.E10  00004810
  482       15   16       9.6E4     1.E10     3.2E4     1.E10     1.E10     1.E10  00004820
  483       16   17       1.0E5     1.E10     3.4E4     1.E10     1.E10     1.E10  00004830
  484       17   18       1.E10     1.E10     1.E10     1.E10     1.E10     1.E10  00004840
  485        2   12       2.1E5     7.2E4     7.2E4     1.E10     1.E10     1.E10  00004850
  486        3   13       2.4E5     8.2E4     8.2E4     1.E10     1.E10     1.E10  00004860
  487        4   14       2.7E5     9.2E4     9.2E4     1.E10     1.E10     1.E10  00004870
  488        5   15       2.7E5     9.2E4     9.2E4     1.E10     1.E10     1.E10  00004880
  489        6   16       1.8E5     6.2E4     6.2E4     1.E10     1.E10     1.E10  00004890
  490        7   17       1.8E5     6.2E4     6.2E4     1.E10     1.E10     1.E10  00004900
  491       15 2 41       4.6E5     1.5E5     1.5E5     1.E10     1.E10     1.E10  00004910
  492       14 1 41       4.6E5     1.5E5     1.5E5     1.E10     1.E10     1.E10  00004920
  493     3 41     0      4.6E5     1.5E5     1.5E5     1.E10     1.E10     1.E10  00004930
  494     4 41     0      4.6E5     1.5E5     1.5E5     1.E10     1.E10     1.E10  00004940
  495     LOAD INTERACTION SIGN CONVENTIONS(NSCV CARDS):                           00004950
  496        1    2   -3    4    5    6                                            00004960
  497     LOAD INTERACTION DATA(NLIC* CARDS):                                      00004970
  498       47    3    5    1    0    5  300.                           1000.      00004980
  499                                    166000.    32.5E+06 -166000.  -32.5E+06   00004990
  500        1    1 215000.   42.5 E+06                                            00005000
  501       216.6    215.7                                                         00005010
  502       31   39   47   55   82                                                 00005020
  503       48    3    5    1    0   10  350.                           1000.      00005030
  504                                    166000.    39.0E+06 -166000.  -39.0E+06   00005040
  505        1    1 260000.   70.0 E+06                                            00005050
  506       215.7    206.4                                                         00005060
  507       32   40   48   56   64   83  102  103  116  117                        00005070
  508       48    3    5    1    0   10  450.                           1000.      00005080
  509                                    210000.    45.0E+06 -210000.  -45.0E+06   00005090
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   510       1    1 300000.   100. E+06                                          00005100
   511     215.7     206.4                                                      00005110
   512      32   40   48   56   64   83  102  103  116  117                      00005120
   513      49    3    5    1    0   10  480.                           1000.    00005130
   514                                   210000.    50.0E+06 -210000.  -50.0E+06  00005140
   515       1    1 400000.   80.0 E+06                                          00005150
   516     206.4     204.7                                                      00005160
   517      33   41   49   57   65   84  104  105  118  119                      00005170
   518      49    3    5    1    0   10  540.                           1000.    00005180
   519                                   210000.    50.0E+06 -210000.  -50.0E+06  00005190
   520       1    1 400000.  100.0 E+06                                          00005200
   521     206.4     204.7                                                      00005210
   522      33   41   49   57   65   84  104  105  118  119                      00005220
   523      49    3    5    2    0   10  600.                           1000.    00005230
   524                                   280000.    62.5E+06 -280000.  -62.5E+06  00005240
   525       1    1 318000.  206.6 E+06                                          00005250
   526       1    1 422400    88.7 E+06                                          00005260
   527     206.4     204.7                                                      00005270
   528      33   41   49   57   65   84  104  105  118  119                      00005280
   529      50    3    5    2    0   11  620.                           1000.    00005290
   530                                   280000.    62.5E+06 -280000.  -62.5E+06  00005300
   531       1    1 318000.  206.6 E+06                                          00005310
   532       1    1 422400    88.7 E+06                                          00005320
   533     204.7     202.0                                                      00005330
   534      34   42   50   58   85  106  107  120  121  133  134                 00005340
   535      50    3    5    2    1   11  820.                           1000.    00005350
   536                                   288000.    62.5E+06 -288000.  -62.5E+06  00005360
   537       1    0-5.2317E06  71.5E+06                                          00005370
   538       1    1 474500.   152.8E+06                                          00005380
   539     204.7     202.0                                                      00005390
   540      34   42   50   58   85  106  107  120  121  133  134                 00005400
   541      51    3    5    2    1   11  820.                           1000.    00005410
   542                                   288000.    62.5E+06 -288000.  -62.5E+06  00005420
   543       1    0-5.2317E06  71.5E+06                                          00005430
   544       1    1 474500.   152.8E+06                                          00005440
   545     202.0     212.4                                                      00005450
   546      35   43   51   59   86  108  109  122  123  135  136                 00005460
   547      51    3    5    2    1   11  960.                           1000.    00005470
   548                                   315000.    96.0E+06 -315000.  -96.0E+06  00005480
   549       1    0-5.7617E06  96.5E+06                                          00005490
   550       1    1 521500.   200.8E+06                                          00005500
   551     202.0     212.4                                                      00005510
   552      35   43   51   59   86  108  109  122  123  135  136                 00005520
   553      52    3    5    2    1   10  960.                           1000.    00005530
   554                                   315000.    96.0E+06 -315000.  -96.0+06   00005540
   555       1    0-5.7617E06  96.5E+06                                          00005550
   556       1    1 521500.   200.8E+06                                          00005560
   557     202.0     207.7                                                      00005570
   558      36   44   52   60   66   87  124  125  110  111                      00005580
   559      52    3    5    2    1   10  990.                           1000.    00005590
   560                                   270000.    84.0E+06 -270000.  -84.0E+06  00005600
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                 1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

    561      1    1 301000.   228.7E+06                                          00005610
    562      1    11.3581E 06  84.2E+06                                          00005620
    563     202.0     207.7                                                      00005630
    564     36   44   52   60   66   87  124  125  110  111                      00005640
    565     53    3    5    3    1   10 1090.                           1000.    00005650
    566                                  270000.    75.0E+06 -270000.  -75.0E+06  00005660
    567      0    1 210000.  -555.88E06                                          00005670
    568      1    1 327700.   107.75E06                                          00005680
    569      1    1 1.5738E06  64.0 E06                                          00005690
    570     207.7     224.2                                                      00005700
    571     37   45   53   61   67   88  112  113  126  127                      00005710
    572     53    3    5    3    1   10 1160.                           1000.    00005720
    573                                  270000.    66.0E+06 -270000.  -66.0E+06  00005730
    574      0    1 239000.  -265.64E06                                          00005740
    575      1    1 372214.    85.0E 06                                          00005750
    576      1    1 804840.    50.0E 06                                          00005760
    577     207.7     224.2                                                      00005770
    578     37   45   53   61   67   88  112  113  126  127                      00005780
    579     54    3    5    1    1   10 1210.                           1000.    00005790
    580                                  235000.  50.0  E 06 -235000.   -50.0E06  00005800
    581      0    1 200000.  -217.32E06                                          00005810
    582     224.2     257.5                                                      00005820
    583     38   46   54   62   68   89  114  115  128  129                      00005830
    584     54    3    5    1    1   10 1320.                           1000.    00005840
    585                                  180000.  40.0  E 06  -180000.  -40.0E06  00005850
    586      0    1 148000.  -91.818E06                                          00005860
    587     224.2     257.5                                                      00005870
    588     38   46   54   62   68   89  114  115  128  129                      00005880
    589     54    3    5    2    1   10 1400.                           1000.    00005890
    590                                  160000.   30.0 E 06  -160000.  -30.0E06  00005900
    591      0    1 123500.  -54.998E06                                          00005910
    592      1    1 350720.    24.2E 06                                          00005920
    593     224.2     257.5                                                      00005930
    594     38   46   54   62   68   89  114  115  128  129                      00005940
    595     63    3    5    2    1    1 1400.                           1000.    00005950
    596                                  160000.   30.0 E 06  -160000.  -30.0E06  00005960
    597      0    1 123500.  -54.998E06                                          00005970
    598      1    1 350720.    24.2E 06                                          00005980
    599     257.2     298.                                                       00005990
    600     63                                                                   00006000
    601  FORCE TIME HISTORY DATA: NACC + CARDS                                   00006010
    602      1    3    2    1                                                    00006020
    603     11    3    2    1                                                    00006030
    604     21    3    2    1                                                    00006040
    605     31    3    2    1                                                    00006050
    606      2    3    2    1                                                    00006060
    607     12    3    2    1                                                    00006070
    608     22    3    2    1                                                    00006080
    609     32    3    2    1                                                    00006090
    610      3    3    2    1                                                    00006100
    611     13    3    2    1                                                    00006110
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                   1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

CARD NO.					
612	23	3	2	1	00006120
613	33	3	2	1	00006130
614	4	3	2	1	00006140
615	14	3	2	1	00006150
616	24	3	2	1	00006160
617	34	3	2	1	00006170
618	5	3	2	1	00006180
619	15	3	2	1	00006190
620	25	3	2	1	00006200
621	35	3	2	1	00006210
622	6	3	2	1	00006220
623	16	3	2	1	00006230
624	26	3	2	1	00006240
625	36	3	2	1	00006250
626	7	3	2	1	00006260
627	17	3	2	1	00006270
628	27	3	2	1	00006280
629	37	3	2	1	00006290
630	8	3	2	1	00006300
631	18	3	2	1	00006310
632	28	3	2	1	00006320
633	38	3	2	1	00006330
634	9	3	2	1	00006340
635	19	3	2	1	00006350
636	29	3	2	1	00006360
637	39	3	2	1	00006370
638	10	3	2	1	00006380
639	20	3	2	1	00006390
640	30	3	2	1	00006400
641	40	3	2	1	00006410
642	41	3	2	1	00006420
643	42	3	2	1	00006430
644	43	3	2	1	00006440
645	44	3	2	1	00006450
646	45	3	2	1	00006460
647	46	3	2	1	00006470
648	47	3	2	1	00006480
649	48	3	2	1	00006490
650	0.		-31.50		00006500
651	1.		-31.50		00006510
652	0.		-16.75		00006520
653	1.		-16.75		00006530
654	0.		-3.9		00006540
655	1.		-3.9		00006550
656	0.		-3.9		00006560
657	1.		-3.9		00006570
658	0.		-282.0		00006580
659	1.		-282.0		00006590
660	0.		-131.0		00006600
661	1.		-131.0		00006610
662	0.		-25.44		00006620

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                   1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   663      1.       -25.44                                                      00006630
   664      0.       -18.86                                                      00006640
   665      1.       -18.86                                                      00006650
   666      0.       -780.                                                       00006660
   667      1.       -780.                                                       00006670
   668      0.       -408.                                                       00006680
   669      1.       -408.                                                       00006690
   670      0.       -72.16                                                      00006700
   671      1.       -72.16                                                      00006710
   672      0.       -53.46                                                      00006720
   673      1.       -53.46                                                      00006730
   674      0.       -2066.                                                      00006740
   675      1.       -2066.                                                      00006750
   676      0.       -1068.                                                      00006760
   677      1.       -1068.                                                      00006770
   678      0.       -181.8                                                      00006780
   679      1.       -181.8                                                      00006790
   680      0.       -134.7                                                      00006800
   681      1.       -134.7                                                      00006810
   682      0.      -3428.6                                                      00006820
   683      1.      -3428.6                                                      00006830
   684      0.      -1786.8                                                      00006840
   685      1.      -1786.8                                                      00006850
   686      0.      - 304.0                                                      00006860
   687      1.      - 304.0                                                      00006870
   688      0.       -228.2                                                      00006880
   689      1.       -228.2                                                      00006890
   690      0.      -1012.0                                                      00006900
   691      1.      -1012.4                                                      00006910
   692      0.       -438.6                                                      00006920
   693      1.       -438.6                                                      00006930
   694      0.       - 76.8                                                      00006940
   695      1.       - 76.8                                                      00006950
   696      0.       - 57.0                                                      00006960
   697      1.       - 57.0                                                      00006970
   698      0.       -948.2                                                      00006980
   699      1.       -948.2                                                      00006990
   700      0.       -496.5                                                      00007000
   701      1.       -496.5                                                      00007010
   702      0.       - 89.7                                                      00007020
   703      1.       - 89.7                                                      00007030
   704      0.       - 66.5                                                      00007040
   705      1.       - 66.5                                                      00007050
   706      0.       -322.5                                                      00007060
   707      1.       -322.5                                                      00007070
   708      0.       -168.5                                                      00007080
   709      1.       -168.5                                                      00007090
   710      0.         -30.2                                                     00007100
   711      1.         -30.2                                                     00007110
   712      0.         -13.9                                                     00007120
   713      1.         -13.9                                                     00007130
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                    1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   714      0.          -202.                                                    00007140
   715      1.          -202.                                                    00007150
   716      0.          -103.                                                    00007160
   717      1.          -103.                                                    00007170
   718      0.         -17.4                                                     00007180
   719      1.          -17.4                                                    00007190
   720      0.          -12.9                                                    00007200
   721      1.          -12.9                                                    00007210
   722      0.        17545.6                                                    00007220
   723      1.        17545.6                                                    00007230
   724      0.          -52.8                                                    00007240
   725      1.          -52.8                                                    00007250
   726      0.          -65.5                                                    00007260
   727      1.          -65.5                                                    00007270
   728      0.          -21.9                                                    00007280
   729      1.          -21.9                                                    00007290
   730      0.        -15420.                                                    00007300
   731      1         -15420.                                                    00007310
   732      0.          -7710.                                                   00007320
   733      1.          -7710.                                                   00007330
   734      0.        -28190.                                                    00007340
   735      1.        -28190.                                                    00007350
   736      0.        -21390.                                                    00007360
   737      1.        -21390.                                                    00007370
   738      0.        -17820.                                                    00007380
   739      1.        -17820.                                                    00007390
   740      0.         -6240.                                                    00007400
   741      1.         -6240.                                                    00007410
   742      0.          -270.8                                                   00007420
   743      1.          -270.8                                                   00007430
   744      0.          -258.                                                    00007440
   745      1.          -258.                                                    00007450
   746  MASS PLOTS:NMEP CARDS                                                    00007460
   747       1                             1    1    1    1                      00007470
   748       2                             1    1    1    1                      00007480
   749       3                             1    1    1    1                      00007490
   750       4                             1    1    1    1                      00007500
   751       5                             1    1    1    1                      00007510
   752       6                             1    1    1    1                      00007520
   753       7                             1    1    1    1                      00007530
   754       8                             1    1    1    1                      00007540
   755       9                             1    1    1    1                      00007550
   756      11                             1    1    1    1                      00007560
   757      12                             1    1    1    1                      00007570
   758      13                             1    1    1    1                      00007580
   759      14                             1    1    1    1                      00007590
   760      15                             1    1    1    1                      00007600
   761      16                             1    1    1    1                      00007610
   762      17                             1    1    1    1                      00007620
   763      18                             1    1    1    1                      00007630
   764      19                             1    1    1    1                      00007640
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

    765     47                             1    1         1                      00007650
    766     48                             1    1         1                      00007660
    767  END                                                                     00008400
```

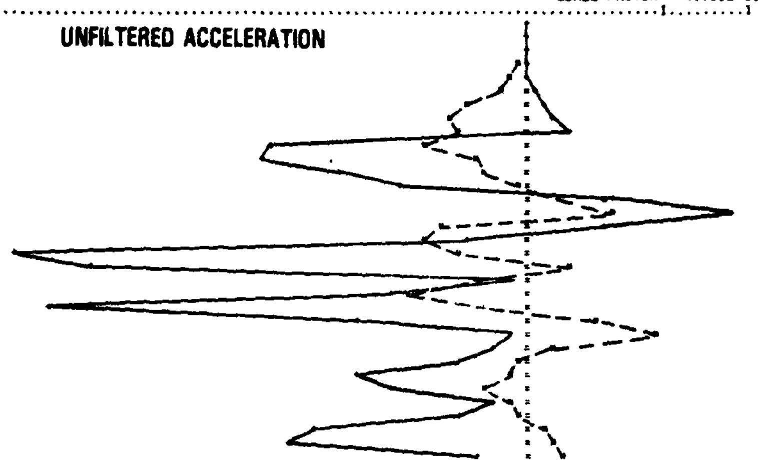
APPENDIX B

APPENDIX B: KRASH TIME HISTORY RESPONSES - EXPANDED MODEL

MASS 2 UNFILTERED ACCELERATION(G'S)

SCALE FACTOR = 4.903E+00

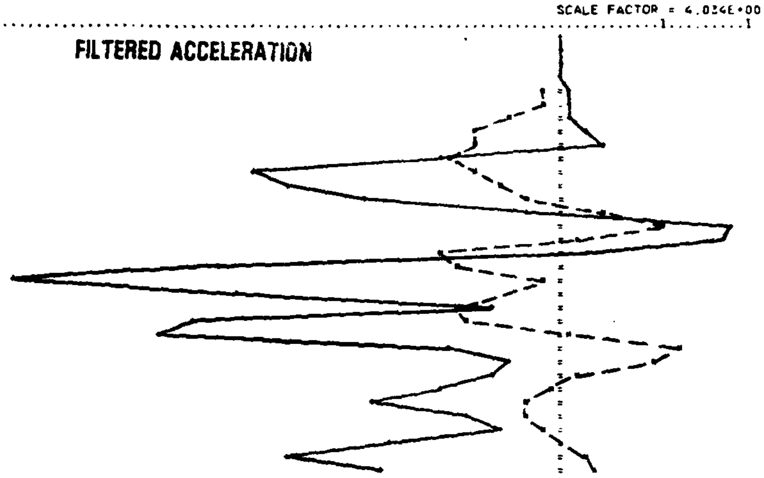
TIME(SEC)	XACC *	YACC x	ZACC +
0.0	1.308E-02	0.0	-3.538E-02
0.005	-7.743E-02	0.0	-1.896E-02
0.010	-2.583E-02	0.0	-2.016E-02
0.015	-5.297E-01	0.0	8.688E-02
0.020	-1.029E+00	0.0	1.070E-01
0.025	-1.532E+00	0.0	2.423E-01
0.030	-3.634E+00	0.0	6.569E-01
0.035	-4.668E+00	0.0	1.247E+00
0.040	-4.071E+00	0.0	2.545E+00
0.045	-6.110E+00	0.0	-1.500E+01
0.050	-3.050E+00	0.0	-1.548E+01
0.055	-2.623E+00	0.0	-1.080E+01
0.060	-5.536E-01	0.0	-7.713E+00
0.065	4.421E+00	0.0	4.735E+00
0.070	5.009E+00	0.0	1.164E+01
0.075	-5.149E+00	0.0	4.457E+00
0.080	-5.951E+00	0.0	-3.668E+00
0.085	-4.124E+00	0.0	-2.955E+01
0.090	2.398E+00	0.0	-2.494E+01
0.095	-2.936E+00	0.0	-1.111E+00
0.100	-6.814E+00	0.0	-7.874E+00
0.105	-2.434E+00	0.0	-2.772E+01
0.110	3.691E+00	0.0	-1.001E+01
0.115	7.436E+00	0.0	-1.301E+01
0.120	1.202E+00	0.0	-2.328E+00
0.125	-3.869E-01	0.0	-3.966E+00
0.130	-1.286E+00	0.0	-9.723E+00
0.135	-2.431E+00	0.0	-7.909E+00
0.140	-1.058E+00	0.0	-2.179E+00
0.145	-6.731E-01	0.0	-3.834E+00
0.150	9.075E-01	0.0	-1.219E+01
0.155	1.300E+00	0.0	-1.380E+01
0.160	1.787E+00	0.0	-3.029E+00



MASS 2 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 4.034E+00

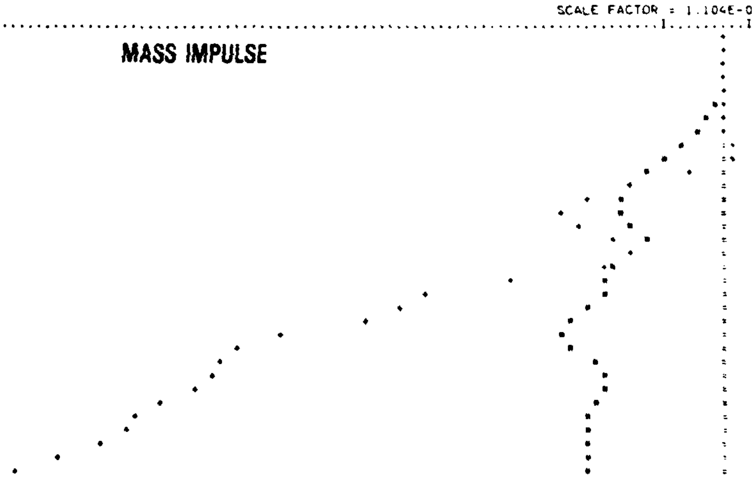
TIME(SEC)	XACCF *	YACCF x	ZACCF +
0.0	0.0	0.0	0.0
0.005	-1.795E-02	0.0	-2.646E-02
0.010	-7.156E-02	0.0	-1.485E-02
0.015	-1.695E-01	0.0	1.239E-02
0.020	-7.769E-01	0.0	1.014E-01
0.025	-1.144E+00	0.0	1.480E-01
0.030	-2.407E+00	0.0	4.095E-01
0.035	-4.043E+00	0.0	8.785E-01
0.040	-4.285E+00	0.0	1.863E+00
0.045	-5.312E+00	0.0	-5.618E+00
0.050	-4.334E+00	0.0	-1.456E+01
0.055	-3.114E+00	0.0	-1.290E+01
0.060	-1.888E+00	0.0	-9.583E+00
0.065	1.921E+00	0.0	-1.875E+00
0.070	4.873E+00	0.0	7.927E+00
0.075	8.126E-01	0.0	7.492E+00
0.080	-5.788E+00	0.0	9.283E-01
0.085	-4.807E+00	0.0	-1.627E+01
0.090	-8.990E-01	0.0	-2.596E+01
0.095	-2.419E-01	0.0	-1.562E+01
0.100	-4.966E+00	0.0	-3.533E+00
0.105	-4.522E+00	0.0	-1.755E+01
0.110	1.0[illegible]E-01	0.0	-1.902E+01
0.115	5.432E+00	0.0	-5.575E+00
0.120	4.124E+00	0.0	-2.567E+00
0.125	5.598E-01	0.0	-3.286E+00
0.130	-4.185E-01	0.0	-5.974E+00
0.135	-1.902E+00	0.0	-9.153E+00
0.140	-1.645E+00	0.0	-4.594E+00
0.145	-9.968E-01	0.0	-3.141E+00
0.150	2.548E-02	0.0	-8.244E+00
0.155	1.055E+00	0.0	-1.200E+01
0.160	1.342E+00	0.0	-8.588E+00



MASS 2 MASS IMPULSES

SCALE FACTOR = 1.104E-01

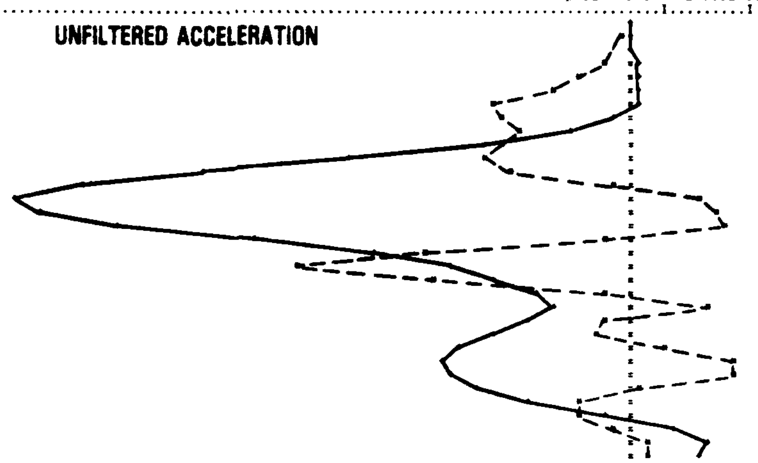
TIME(SEC)	XIMP *	YIMP x	ZIMP +
0.0	0.0	0.0	0.0
0.005	2.896E-06	0.0	-1.020E-04
0.010	-3.023E-04	0.0	-1.940E-04
0.015	-6.207E-04	0.0	-2.563E-04
0.020	-3.128E-03	0.0	9.029E-05
0.025	-7.870E-03	0.0	6.521E-04
0.030	-1.626E-02	0.0	1.966E-03
0.035	-3.297E-02	0.0	5.153E-03
0.040	-5.438E-02	0.0	1.178E-02
0.045	-7.760E-02	0.0	9.579E-03
0.050	-1.034E-01	0.0	-4.832E-02
0.055	-1.213E-01	0.0	-1.187E-01
0.060	-1.342E-01	0.0	-1.745E-01
0.065	-1.346E-01	0.0	-2.059E-01
0.070	-1.162E-01	0.0	-1.889E-01
0.075	-9.824E-02	0.0	-1.461E-01
0.080	-1.15[illegible]E-01	0.0	-1.244E-01
0.085	-1.42[illegible]E-01	0.0	-1.563E-01
0.090	-1.5[illegible]4E-01	0.0	-2.724E-01
0.095	-1.569E-01	0.0	-3.848E-01
0.100	-1.709E-01	0.0	-4.183E-01
0.105	-1.973E-01	0.0	-4.675E-01
0.110	-2.089E-01	0.0	-5.726E-01
0.115	-1.958E-01	0.0	-6.285E-01
0.120	-1.665E-01	0.0	-6.460E-01
0.125	-1.55[illegible]E-01	0.0	-6.601E-01
0.130	-1.56[illegible]E-01	0.0	-6.809E-01
0.135	-1.623E-01	0.0	-7.225E-01
0.140	-1.720E-01	0.0	-7.573E-01
0.145	-1.783E-01	0.0	-7.752E-01
0.150	-1.810E-01	0.0	-8.020E-01
0.155	-1.778[illegible]	0.0	-8.575E-01
0.160	-1.720E-0[illegible]	0.0	-9.155E-01



MASS 3 UNFILTERED ACCELERATION(G'S)

TIME(SEC)	XACC	YACC	ZACC
0.0	1.312E-02	0.0	-3.280E-02
0.005	-9.755E-02	0.0	-1.543E-03
0.010	-6.640E-02	0.0	2.604E-03
0.015	-6.720E-01	0.0	1.909E-01
0.020	-1.261E+00	0.0	2.388E-01
0.025	-2.157E+00	0.0	2.445E-01
0.030	-3.713E+00	0.0	2.691E-01
0.035	-3.373E+00	0.0	3.612E-01
0.040	-2.954E+00	0.0	-1.540E+00
0.045	-3.509E+00	0.0	-3.950E+00
0.050	-3.975E+00	0.0	-7.782E+00
0.055	-3.305E+00	0.0	-1.167E+01
0.060	-4.762E-01	0.0	-1.499E+01
0.065	1.835E+00	0.0	-1.680E+01
0.070	2.349E+00	0.0	-1.618E+01
0.075	2.662E+00	0.0	-1.389E+01
0.080	-6.462E-01	0.0	-1.036E+01
0.085	-5.462E+00	0.0	-6.990E+00
0.090	-8.992E+00	0.0	-4.818E+00
0.095	-5.420E+00	0.0	-3.719E+00
0.100	-6.032E-01	0.0	-2.645E+00
0.105	2.095E+00	0.0	-2.178E+00
0.110	-6.919E-01	0.0	-2.797E+00
0.115	-8.700E-01	0.0	-3.653E+00
0.120	8.878E-01	0.0	-4.624E+00
0.125	2.828E+00	0.0	-5.091E+00
0.130	2.751E+00	0.0	-4.932E+00
0.135	2.385E-01	0.0	-4.247E+00
0.140	-1.478E+00	0.0	-2.722E+00
0.145	-1.315E+00	0.0	-6.922E-01
0.150	-3.460E-01	0.0	1.175E+00
0.155	4.066E-01	0.0	2.062E+00
0.160	5.646E-01	0.0	1.932E+00

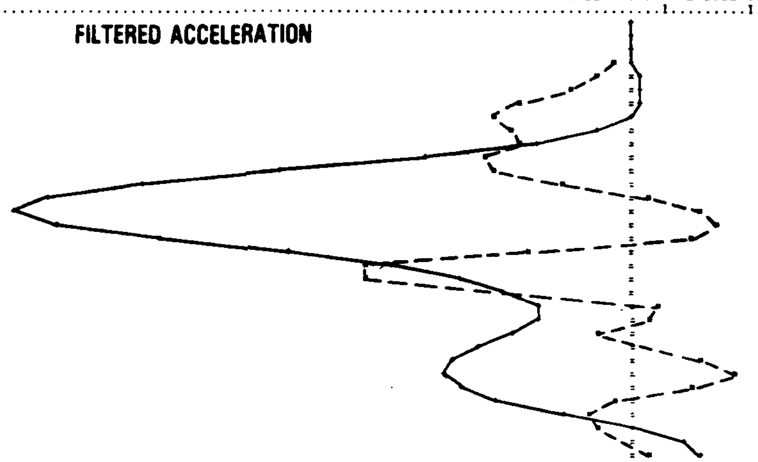
SCALE FACTOR = 2.338E+00



MASS 3 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF	YACCF	ZACCF
0.0	0.0	0.0	0.0
0.005	-3.724E-02	0.0	-1.897E-02
0.010	[illegible]	0.0	3.608E-03
0.015	-3.449E-01	0.0	7.611E-02
0.020	-8.785E-01	0.0	2.054E-01
0.025	-1.577E+00	0.0	2.396E-01
0.030	-2.882E+00	0.0	2.459E-01
0.035	-3.529E+00	0.0	2.832E-02
0.040	-3.102E+00	0.0	-8.427E-01
0.045	-3.060E+00	0.0	-2.457E+00
0.050	-3.876E+00	0.0	-5.512E+00
0.055	[illegible]	0.0	-9.266E+00
0.060	-1.920E+00	0.0	-1.287E+01
0.065	[illegible]	0.0	-1.559E+01
0.070	[illegible]	0.0	-1.629E+01
0.075	[illegible]	0.0	-1.518E+01
0.080	1.644E+00	0.0	-1.245E+01
0.085	-2.842E+00	0.0	-9.049E+00
0.090	[illegible]	0.0	-6.268E+00
0.095	[illegible]	0.0	-4.535E+00
0.100	-3.439E+00	0.0	-3.360E+00
0.105	[illegible]	0.0	-2.462E+00
0.110	4.352E-01	0.0	-2.514E+00
0.115	-8.196E-01	0.0	-3.149E+00
0.120	3.726E-02	0.0	-4.036E+00
0.125	1.744E+00	0.0	-4.785E+00
0.130	2.744E+00	0.0	-4.976E+00
0.135	1.566E+00	0.0	-4.648E+00
0.140	-5.096E-01	0.0	-3.626E+00
0.145	-1.224E+00	0.0	-1.918E+00
0.150	-8.922E-01	0.0	1.891E-02
0.155	[illegible]	0.0	1.461E+00
0.160	3.926E-01	0.0	1.932E+00

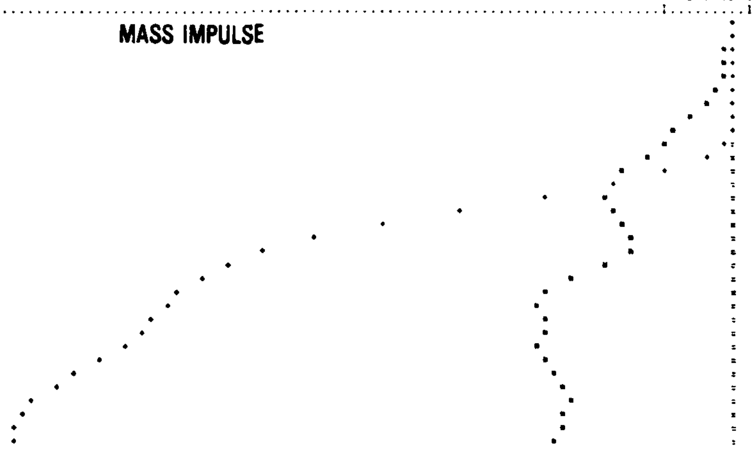
SCALE FACTOR = 2.278E+00



MASS 3 MASS IMPULSES

TIME(SEC)	XIMP	YIMP	ZIMP
0.0	0.0	0.0	0.0
0.005	-3.312E-05	0.0	-9.084E-05
0.010	[illegible]	0.0	-1.124E-04
0.015	[illegible]	0.0	-4.427E-06
0.020	[illegible]	0.0	7.710E-04
0.025	-1.025E-02	0.0	1.901E-03
0.030	[illegible]	0.0	3.084E-03
0.035	-3.788E-02	0.0	4.021E-03
0.040	-5.432E-02	0.0	2.117E-03
0.045	-6.924E-02	0.0	-5.705E-03
0.050	-8.705E-02	0.0	-2.532E-02
0.055	-1.062E-01	0.0	-6.243E-02
0.060	-1.209E-01	0.0	-1.182E-01
0.065	-1.246E-01	0.0	-1.901E-01
0.070	-1.182E-01	0.0	-2.711E-01
0.075	-1.079E-01	0.0	-3.506E-01
0.080	[illegible]	0.0	-4.200E-01
0.085	-9.868E-02	0.0	-4.725E-01
0.090	[illegible]	0.0	-5.112E-01
0.095	-1.614E-01	0.0	-5.377E-01
0.100	[illegible]	0.0	-5.573E-01
0.105	-1.929E-01	0.0	-5.716E-01
0.110	-1.894E-01	0.0	-5.837E-01
0.115	[illegible]	0.0	-5.978E-01
0.120	-1.937E-01	0.0	-6.157E-01
0.125	-1.892E-01	0.0	-6.380E-01
0.130	-1.772E-01	0.0	-6.627E-01
0.135	-1.657E-01	0.0	-6.869E-01
0.140	-1.635E-01	0.0	-7.079E-01
0.145	-1.684E-01	0.0	-7.218E-01
0.150	-1.742E-01	0.0	-7.264E-01
0.155	[illegible]	0.0	-7.222E-01
0.160	-1.750E-01	0.0	-7.133E-01

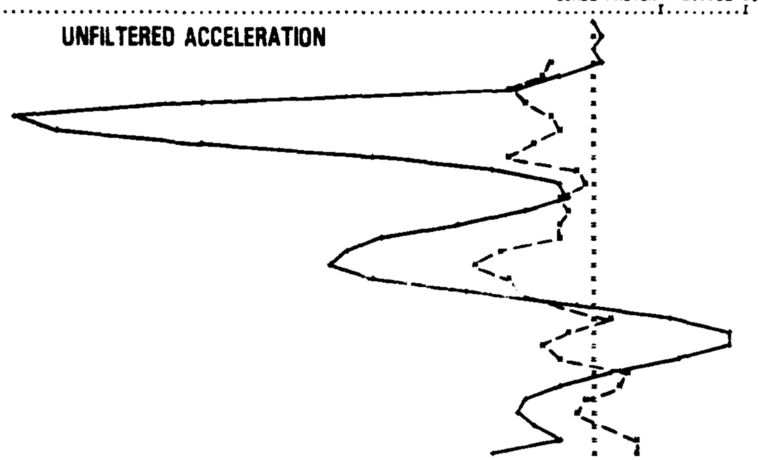
SCALE FACTOR = 8.696E-02



MASS 4 UNFILTERED ACCELERATION(G'S)

TIME(SEC)	XACC *	YACC *	ZACC +
0.0	1.316E-02	0.0	-3.009E-02
0.005	-2.156E-01	0.0	6.345E-02
0.010	-1.114E-01	0.0	1.833E-02
0.015	-1.453E+00	0.0	8.585E-02
0.020	-1.848E+00	0.0	-1.085E+00
0.025	-2.804E+00	0.0	-2.708E+00
0.030	-2.338E+00	0.0	-1.283E+01
0.035	-1.416E+00	0.0	-1.897E+01
0.040	-1.286E+00	0.0	-1.752E+01
0.045	-2.090E+00	0.0	-1.292E+01
0.050	-2.929E+00	0.0	-7.415E+00
0.055	-5.279E-01	0.0	-3.363E+00
0.060	-3.830E-01	0.0	-1.242E+00
0.065	-1.095E+00	0.0	-8.733E-01
0.070	-8.522E-01	0.0	-2.202E+00
0.075	-1.111E+00	0.0	-4.620E+00
0.080	-1.140E+00	0.0	-7.005E+00
0.085	-3.283E+00	0.0	-8.284E+00
0.090	-3.983E+00	0.0	-8.670E+00
0.095	-2.844E+00	0.0	-7.234E+00
0.100	-2.468E+00	0.0	-4.378E+00
0.105	-2.022E-01	0.0	-7.189E-01
0.110	4.812E-01	0.0	2.437E+00
0.115	-9.179E-01	0.0	4.309E+00
0.120	-1.733E+00	0.0	4.337E+00
0.125	-1.084E+00	0.0	2.712E+00
0.130	1.057E+00	0.0	5.410E-01
0.135	8.495E-01	0.0	-1.277E+00
0.140	-2.691E-01	0.0	-2.233E+00
0.145	-6.445E-01	0.0	-2.574E+00
0.150	-3.726E-02	0.0	-2.096E+00
0.155	1.182E+00	0.0	-1.128E+00
0.160	1.405E+00	0.0	-3.296E+00

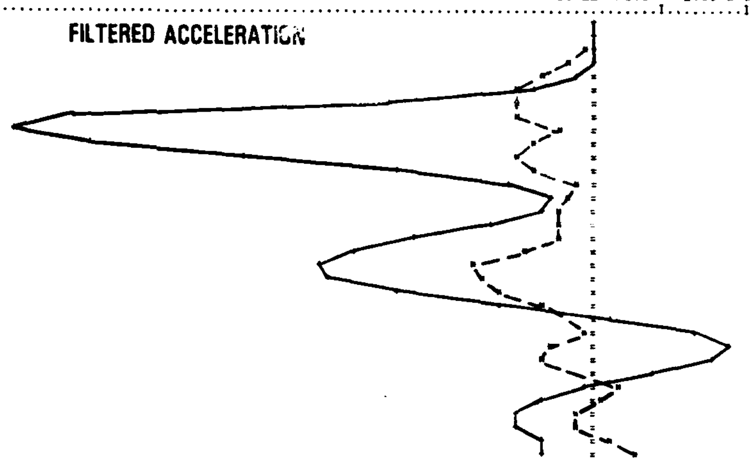
SCALE FACTOR = 2.775E+00



MASS 4 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF *	YACCF *	ZACCF +
0.0	0.0	0.0	0.0
0.005	-1.089E-01	0.0	5.584E-03
0.010	-1.268E-01	0.0	5.156E-02
0.015	-8.226E-01	0.0	7.158E-02
0.020	-1.523E+00	0.0	-4.046E-01
0.025	-2.341E+00	0.0	-1.774E+00
0.030	-2.348E+00	0.0	-6.393E+00
0.035	-2.282E+00	0.0	-1.583E+01
0.040	-1.152E+00	0.0	-1.777E+01
0.045	-1.895E+00	0.0	-1.545E+01
0.050	-2.357E+00	0.0	-1.068E+01
0.055	-1.741E+00	0.0	-5.906E+00
0.060	-5.534E-01	0.0	-2.734E+00
0.065	-7.366E-01	0.0	-1.263E+00
0.070	-1.109E+00	0.0	-1.511E+00
0.075	-1.066E+00	0.0	-3.216E+00
0.080	-9.275E-01	0.0	-5.562E+00
0.085	-2.120E+00	0.0	-7.400E+00
0.090	-3.590E+00	0.0	-8.375E+00
0.095	-3.271E+00	0.0	-8.028E+00
0.100	-2.839E+00	0.0	-6.045E+00
0.105	-1.438E+00	0.0	-2.926E+00
0.110	4.412E-02	0.0	4.594E-01
0.115	-2.506E-01	0.0	3.047E+00
0.120	-1.272E+00	0.0	4.193E+00
0.125	-1.520E+00	0.0	3.563E+00
0.130	-8.179E-02	0.0	1.825E+00
0.135	8.697E-01	0.0	-1.970E-01
0.140	2.568E-01	0.0	-1.556E+00
0.145	-3.944E-01	0.0	-2.310E+00
0.150	-3.855E-01	0.0	-2.333E+00
0.155	5.516E-01	0.0	-1.671E+00
0.160	1.245E+00	0.0	-1.494E+00

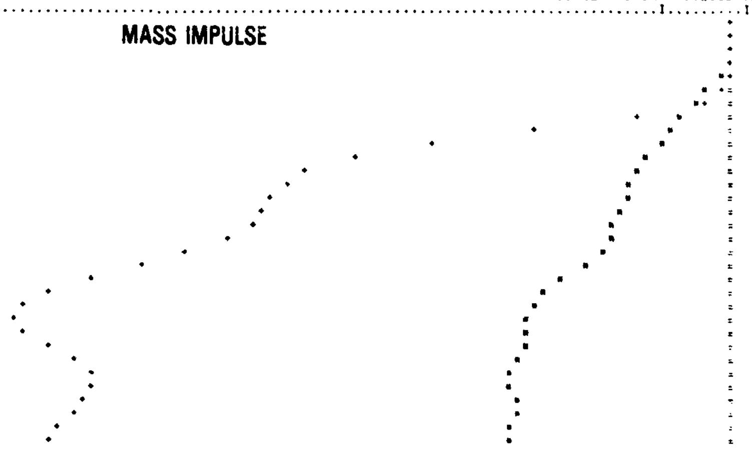
SCALE FACTOR = 2.614E+00



MASS 4 MASS IMPULSES

TIME(SEC)	XIMP *	YIMP *	ZIMP +
0.0	0.0	0.0	0.0
0.005	-1.765E-04	0.0	-6.751E-05
0.010	-8.829E-04	0.0	1.467E-04
0.015	-2.759E-03	0.0	3.760E-04
0.020	-8.971E-03	0.0	-1.857E-06
0.025	-1.852E-02	0.0	-5.377E-03
0.030	-3.353E-02	0.0	-2.167E-02
0.035	-4.288E-02	0.0	-8.036E-02
0.040	-5.061E-02	0.0	-1.666E-01
0.045	-5.826E-02	0.0	-2.511E-01
0.050	-6.853E-02	0.0	-3.165E-01
0.055	-8.304E-02	0.0	-3.572E-01
0.060	-8.491E-02	0.0	-3.779E-01
0.065	-8.782E-02	0.0	-3.871E-01
0.070	-9.293E-02	0.0	-3.933E-01
0.075	-9.800E-02	0.0	-4.048E-01
0.080	-1.075E-01	0.0	-4.269E-01
0.085	-1.098E-01	0.0	-4.597E-01
0.090	-1.248E-01	0.0	-4.996E-01
0.095	-1.426E-01	0.0	-5.413E-01
0.100	-1.578E-01	0.0	-5.770E-01
0.105	-1.691E-01	0.0	-5.996E-01
0.110	-1.719E-01	0.0	-6.053E-01
0.115	-1.717E-01	0.0	-5.959E-01
0.120	-1.757E-01	0.0	-5.770E-01
0.125	-1.833E-01	0.0	-5.570E-01
0.130	-1.876E-01	0.0	-5.434E-01
0.135	-1.843E-01	0.0	-5.396E-01
0.140	-1.817E-01	0.0	-5.443E-01
0.145	-1.823E-01	0.0	-5.543E-01
0.150	-1.846E-01	0.0	-5.662E-01
0.155	-1.843E-01	0.0	-5.764E-01
0.160	-1.795E-01	0.0	-5.830E-01

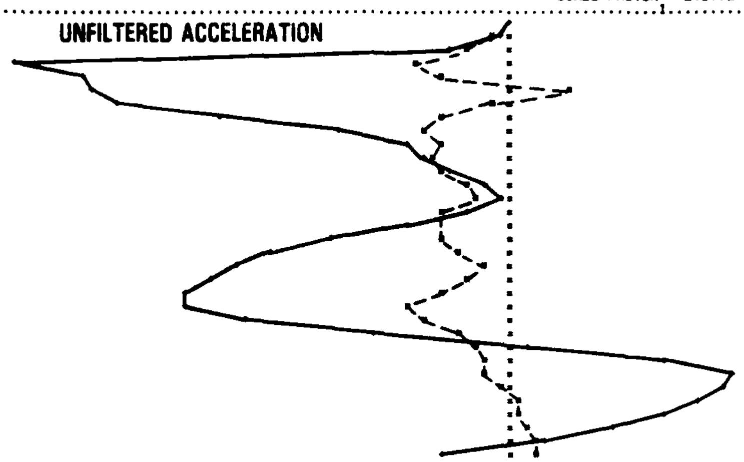
SCALE FACTOR = 7.211E-02



MASS 5 UNFILTERED ACCELERATION(G'S)

SCALE FACTOR = 2.297E+00

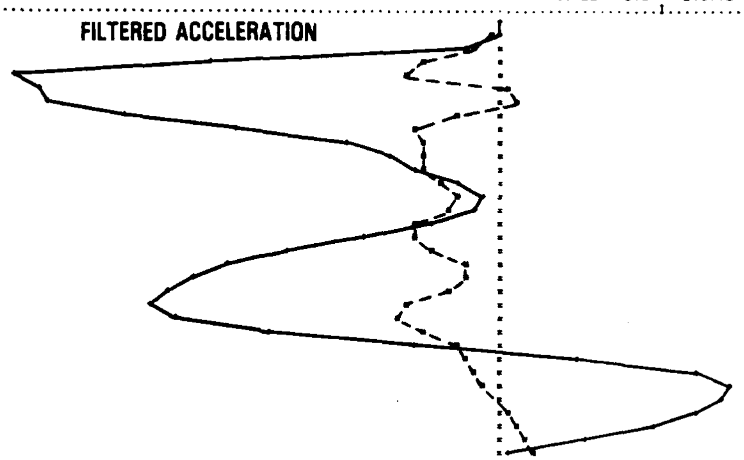
TIME(SEC)	XACC *	YACC x	ZACC +
0.0	1.311E-02	0.0	-2.681E-02
0.005	-4.358E-01	0.0	-2.163E-01
0.010	-1.246E+00	0.0	-1.648E+00
0.015	-2.467E+00	0.0	-1.331E+01
0.020	-1.872E+00	0.0	-1.152E+01
0.025	1.547E+00	0.0	-1.136E+01
0.030	-3.751E-01	0.0	-1.057E+01
0.035	-1.895E+00	0.0	-7.819E+00
0.040	-2.180E+00	0.0	-4.668E+00
0.045	-1.842E+00	0.0	-2.696E+00
0.050	-2.118E+00	0.0	-2.358E+00
0.055	-1.843E+00	0.0	-1.686E+00
0.060	-1.187E+00	0.0	-5.728E-01
0.065	-9.454E-01	0.0	-2.909E-01
0.070	-1.845E+00	0.0	-1.110E+00
0.075	-2.683E+00	0.0	-2.720E+00
0.080	-1.793E+00	0.0	-4.745E+00
0.085	-1.413E+00	0.0	-6.352E+00
0.090	-5.774E-01	0.0	-7.421E+00
0.095	-1.158E+00	0.0	-8.067E+00
0.100	-1.914E+00	0.0	-8.731E+00
0.105	-2.789E+00	0.0	-8.821E+00
0.110	-2.384E+00	0.0	-7.171E+00
0.115	-1.405E+00	0.0	-3.772E+00
0.120	-9.024E-01	0.0	4.116E-01
0.125	-6.993E-01	0.0	4.072E+00
0.130	-7.469E-01	0.0	5.982E+00
0.135	-1.661E-01	0.0	5.648E+00
0.140	1.323E-01	0.0	5.067E+00
0.145	2.055E-01	0.0	4.190E+00
0.150	5.523E-01	0.0	2.754E+00
0.155	7.511E-01	0.0	8.841E-01
0.160	7.598E-01	0.0	-1.786E+00



MASS 5 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 2.099E+00

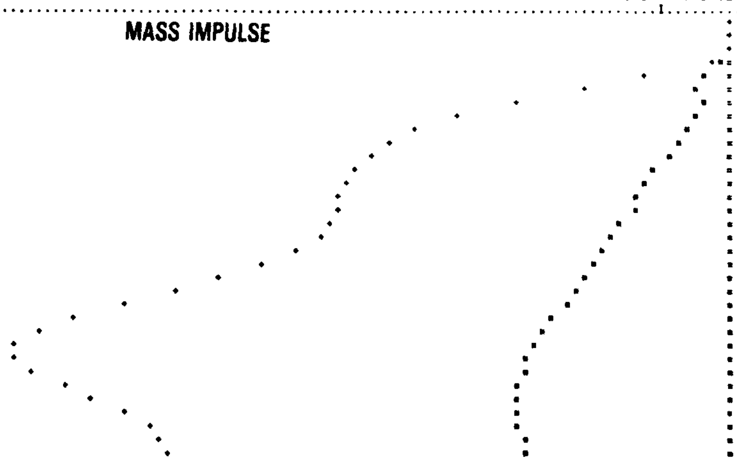
TIME(SEC)	XACCF *	YACCF x	ZACCF +
0.0	0.0	0.0	0.0
0.005	-2.615E-01	0.0	-6.510E-02
0.010	-7.062E-01	0.0	-8.250E-01
0.015	-2.049E+00	0.0	-7.292E+00
0.020	-2.412E+00	0.0	-1.204E+01
0.025	1.250E-01	0.0	-1.149E+01
0.030	2.777E-01	0.0	-1.111E+01
0.035	-1.025E+00	0.0	-9.407E+00
0.040	-2.103E+00	0.0	-6.583E+00
0.045	-1.886E+00	0.0	-3.948E+00
0.050	-2.035E+00	0.0	-2.747E+00
0.055	-2.008E+00	0.0	-2.193E+00
0.060	-1.598E+00	0.0	-1.211E+00
0.065	-1.113E+00	0.0	-4.936E-01
0.070	-1.282E+00	0.0	-6.761E-01
0.075	-2.170E+00	0.0	-1.759E+00
0.080	-2.210E+00	0.0	-3.533E+00
0.085	-1.706E+00	0.0	-5.328E+00
0.090	-9.563E-01	0.0	-6.702E+00
0.095	-9.582E-01	0.0	-7.604E+00
0.100	-1.399E+00	0.0	-8.292E+00
0.105	-2.346E+00	0.0	-8.783E+00
0.110	-2.515E+00	0.0	-8.114E+00
0.115	-1.965E+00	0.0	-5.774E+00
0.120	-1.208E+00	0.0	-2.116E+00
0.125	-8.722E-01	0.0	1.766E+00
0.130	-7.193E-01	0.0	4.784E+00
0.135	-4.899E-01	0.0	5.589E+00
0.140	-1.676E-02	0.0	5.361E+00
0.145	9.654E-02	0.0	4.722E+00
0.150	3.597E-01	0.0	3.626E+00
0.155	6.172E-01	0.0	2.023E+00
0.160	7.456E-01	0.0	1.345E-01



MASS 5 MASS IMPULSES

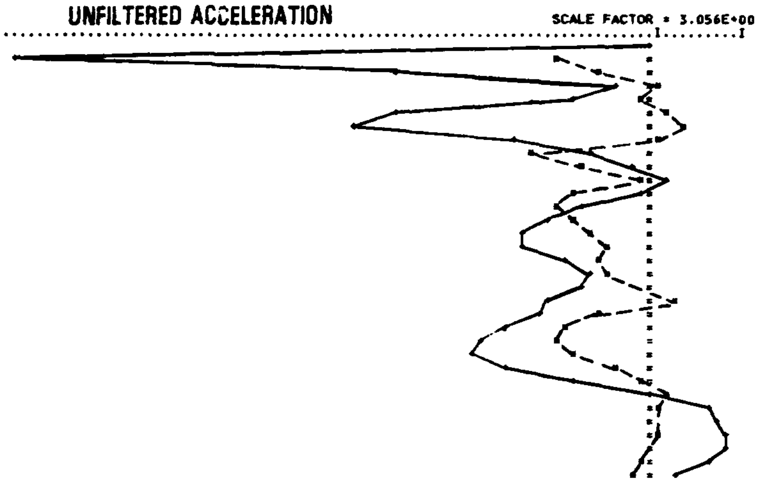
SCALE FACTOR = 7.591E-02

TIME(SEC)	XIMP *	YIMP x	ZIMP +
0.0	0.0	0.0	0.0
0.005	-5.700E-04	0.0	-1.057E-04
0.010	-2.782E-03	0.0	-1.920E-03
0.015	-1.009E-02	0.0	-1.866E-02
0.020	-2.185E-02	0.0	-7.239E-02
0.025	-2.807E-02	0.0	-1.309E-01
0.030	-2.563E-02	0.0	-1.876E-01
0.035	-2.735E-02	0.0	-2.395E-01
0.040	-3.587E-02	0.0	-2.795E-01
0.045	-4.593E-02	0.0	-3.052E-01
0.050	-5.568E-02	0.0	-3.213E-01
0.055	-6.601E-02	0.0	-3.338E-01
0.060	-7.519E-02	0.0	-3.423E-01
0.065	-8.175E-02	0.0	-3.462E-01
0.070	-8.726E-02	0.0	-3.487E-01
0.075	-9.602E-02	0.0	-3.545E-01
0.080	-1.077E-01	0.0	-3.677E-01
0.085	-1.173E-01	0.0	-3.901E-01
0.090	-1.240E-01	0.0	-4.205E-01
0.095	-1.283E-01	0.0	-4.565E-01
0.100	-1.341E-01	0.0	-4.963E-01
0.105	-1.435E-01	0.0	-5.393E-01
0.110	-1.561E-01	0.0	-5.821E-01
0.115	-1.675E-01	0.0	-6.174E-01
0.120	-1.752E-01	0.0	-6.372E-01
0.125	-1.803E-01	0.0	-6.377E-01
0.130	-1.841E-01	0.0	-6.204E-01
0.135	-1.874E-01	0.0	-5.937E-01
0.140	-1.885E-01	0.0	-5.661E-01
0.145	-1.883E-01	0.0	-5.408E-01
0.150	-1.872E-01	0.0	-5.198E-01
0.155	-1.847E-01	0.0	-5.056E-01
0.160	-1.812E-01	0.0	-5.002E-01



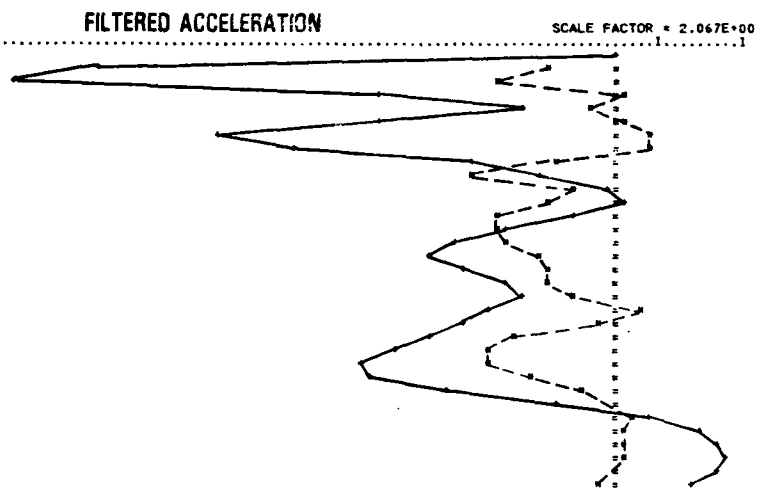
MASS 6 UNFILTERED ACCELERATION(G'S)

TIME(SEC)	XACC *	YACC *	ZACC +
0.0	1.317E-02	0.0	-2.453E-02
0.005	-3.382E+00	0.0	-2.290E+01
0.010	-1.899E+00	0.0	-9.225E+00
0.015	3.846E-01	0.0	-1.274E+00
0.020	-2.889E-01	0.0	-2.580E+00
0.025	4.944E-01	0.0	-9.100E+00
0.030	1.363E+00	0.0	-1.058E+01
0.035	3.491E-01	0.0	-4.979E+00
0.040	-4.172E+00	0.0	-1.982E+00
0.045	-2.444E+00	0.0	-7.142E-01
0.050	-2.972E-01	0.0	5.131E-01
0.055	-2.822E+00	0.0	-1.475E-01
0.060	-3.415E+00	0.0	-2.335E+00
0.065	-2.772E+00	0.0	-3.504E+00
0.070	-2.185E+00	0.0	-4.459E+00
0.075	-1.445E+00	0.0	-4.525E+00
0.080	-1.657E+00	0.0	-3.035E+00
0.085	-1.585E+00	0.0	-2.100E+00
0.090	6.893E-03	0.0	-2.537E+00
0.095	8.533E-01	0.0	-3.561E+00
0.100	-1.887E+00	0.0	-4.006E+00
0.105	-3.154E+00	0.0	-5.119E+00
0.110	-3.186E+00	0.0	-5.982E+00
0.115	-2.727E+00	0.0	-6.504E+00
0.120	-1.094E+00	0.0	-5.285E+00
0.125	-2.269E-01	0.0	-2.598E+00
0.130	5.229E-01	0.0	1.100E-01
0.135	2.869E-01	0.0	2.033E+00
0.140	4.707E-02	0.0	2.621E+00
0.145	2.728E-01	0.0	2.657E+00
0.150	3.513E-02	0.0	2.775E+00
0.155	-2.040E-01	0.0	2.295E+00
0.160	-4.985E-01	0.0	1.085E+00



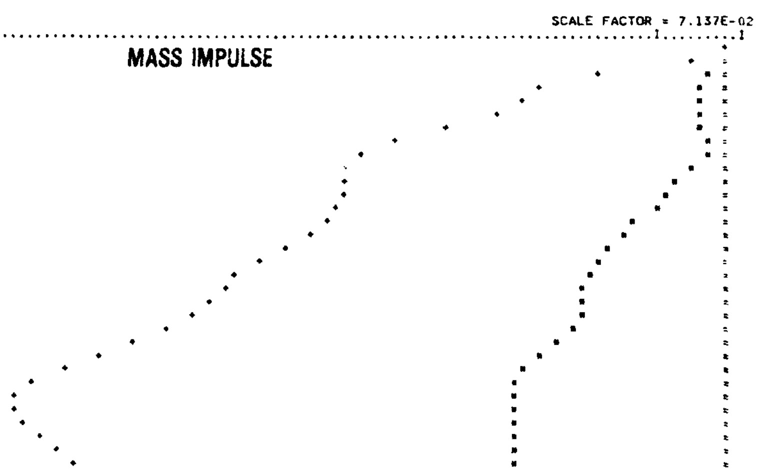
MASS 6 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF *	YACCF =	ZACCF +
0.0	0.0	0.0	0.0
0.005	-1.578E+00	0.0	-1.267E+01
0.010	-2.859E+00	0.0	-1.466E+01
0.015	1.841E-01	0.0	-5.812E+00
0.020	-5.739E-01	0.0	-2.281E+00
0.025	1.462E-01	0.0	-5.848E+00
0.030	9.428E-01	0.0	-9.650E+00
0.035	9.092E-01	0.0	-7.915E+00
0.040	-1.407E+00	0.0	-3.570E+00
0.045	-3.426E+00	0.0	-1.845E+00
0.050	-1.099E+00	0.0	-1.920E-01
0.055	-1.693E+00	0.0	1.315E-01
0.060	-2.980E+00	0.0	-1.110E+00
0.065	-2.975E+00	0.0	-2.714E+00
0.070	-2.591E+00	0.0	-3.826E+00
0.075	-1.854E+00	0.0	-4.501E+00
0.080	-1.631E+00	0.0	-3.803E+00
0.085	-1.628E+00	0.0	-2.651E+00
0.090	-9.453E-01	0.0	-2.325E+00
0.095	5.326E-01	0.0	-3.071E+00
0.100	-4.967E-01	0.0	-3.634E+00
0.105	-2.414E+00	0.0	-4.475E+00
0.110	-2.984E+00	0.0	-5.432E+00
0.115	-3.047E+00	0.0	-6.192E+00
0.120	-1.953E+00	0.0	-5.960E+00
0.125	-8.210E-01	0.0	-4.138E+00
0.130	6.878E-02	0.0	-1.533E+00
0.135	3.542E-01	0.0	7.838E-01
0.140	1.292E-01	0.0	2.145E+00
0.145	2.152E-01	0.0	2.534E+00
0.150	1.234E-01	0.0	2.701E+00
0.155	-3.463E-02	0.0	2.579E+00
0.160	-4.108E-01	0.0	1.781E+00



MASS 6 MASS IMPULSES

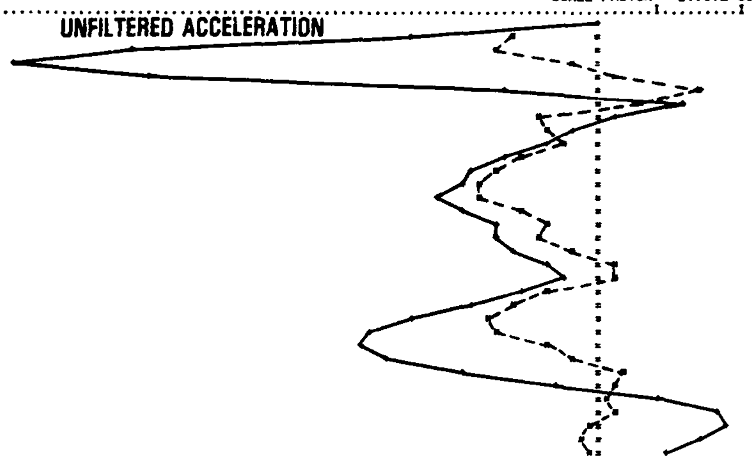
TIME(SEC)	XIMP *	YIMP =	ZIMP +
0.0	0.0	0.0	0.0
0.005	-3.202E-03	0.0	-2.638E-02
0.010	-1.615E-02	0.0	-1.070E-01
0.015	-2.200E-02	0.0	-1.570E-01
0.020	-2.347E-02	0.0	-1.738E-01
0.025	-2.440E-02	0.0	-1.925E-01
0.030	-2.172E-02	0.0	-2.330E-01
0.035	-1.647E-02	0.0	-2.794E-01
0.040	-1.589E-02	0.0	-3.067E-01
0.045	-3.076E-02	0.0	-3.199E-01
0.050	-4.167E-02	0.0	-3.245E-01
0.055	-4.737E-02	0.0	-3.240E-01
0.060	-5.971E-02	0.0	-3.259E-01
0.065	-7.506E-02	0.0	-3.359E-01
0.070	-8.914E-02	0.0	-3.524E-01
0.075	[illegible]	0.0	-3.737E-01
0.080	[illegible]	0.0	-3.949E-01
0.085	-1.168E-01	0.0	-4.108E-01
0.090	-1.238E-01	0.0	-4.227E-01
0.095	-1.243E-01	0.0	-4.361E-01
0.100	[illegible]	0.0	-4.530E-01
0.105	[illegible]	0.0	-4.731E-01
0.110	-1.449E-01	0.0	-4.980E-01
0.115	-1.605E-01	0.0	-5.273E-01
0.120	[illegible]	0.0	-5.583E-01
0.125	-1.796E-01	0.0	-5.840E-01
0.130	-1.815E-01	0.0	-5.980E-01
0.135	[illegible]	0.0	-5.995E-01
0.140	-1.789E-01	0.0	-5.916E-01
0.145	-1.782E-01	0.0	-5.796E-01
0.150	[illegible]	0.0	-5.665E-01
0.155	[illegible]	[illegible]	-5.531E-01
0.160	-1.781E-01	0.0	-5.420E-01



MASS 7 UNFILTERED ACCELERATION(G'S)

TIME(SEC)	XACC *	YACC x	ZACC +
0.0	1.334E-02	0.0	-2.314E-02
0.005	-2.783E+00	0.0	-6.028E+00
0.010	-3.181E+00	0.0	-1.479E+01
0.015	-6.711E-01	0.0	-1.863E+01
0.020	6.956E-01	0.0	-1.417E+01
0.025	3.421E+00	0.0	-2.970E+00
0.030	1.310E+00	0.0	2.668E+00
0.035	-1.958E+00	0.0	6.915E-01
0.040	-1.554E+00	0.0	-6.347E-01
0.045	[illegible]	0.0	-1.472E+00
0.050	-2.265E+00	0.0	-2.958E+00
0.055	-3.299E+00	0.0	-4.061E+00
0.060	-3.765E+00	0.0	-4.308E+00
0.065	-3.618E+00	0.0	-5.057E+00
0.070	-2.403E+00	0.0	-4.294E+00
0.075	-1.556E+00	0.0	-3.183E+00
0.080	-1.837E+00	0.0	-3.129E+00
0.085	-6.631E-01	0.0	-2.761E+00
0.090	6.043E-01	0.0	-1.620E+00
0.095	6.547E-01	0.0	-9.400E-01
0.100	-1.521E+00	0.0	-2.424E+00
0.105	-2.597E+00	0.0	-4.136E+00
0.110	-3.560E+00	0.0	-6.005E+00
0.115	-3.063E+00	0.0	-7.374E+00
0.120	-1.678E+00	0.0	-7.650E+00
0.125	-7.491E-01	0.0	-6.720E+00
0.130	7.913E-01	0.0	-4.393E+00
0.135	7.190E-01	0.0	-1.342E+00
0.140	3.180E-01	0.0	1.866E+00
0.145	5.757E-01	0.0	3.935E+00
0.150	-2.737E-01	0.0	4.124E+00
0.155	-5.231E-01	0.0	3.215E+00
0.160	-1.460E-01	0.0	2.178E+00

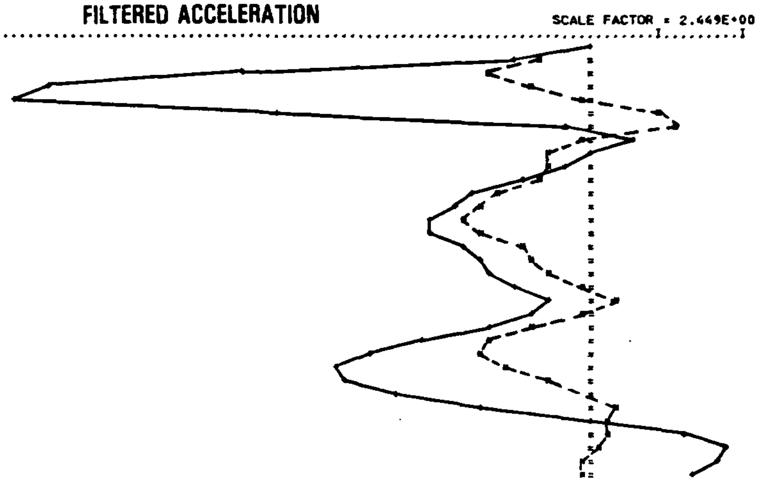
SCALE FACTOR = 2.709E+00



MASS 7 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF *	YACCF x	ZACCF +
0.0	0.0	0.0	0.0
0.005	-1.483E+00	0.0	-2.326E+00
0.010	-2.935E+00	0.0	-1.003E+01
0.015	-1.834E+00	0.0	-1.582E+01
0.020	-1.873E-01	0.0	-1.671E+01
0.025	1.897E+00	0.0	-9.039E+00
0.030	2.358E+00	0.0	-8.857E-01
0.035	-1.941E-01	0.0	1.235E+00
0.040	-1.320E+00	0.0	-8.622E-02
0.045	-1.197E+00	0.0	-8.500E-01
0.050	-1.570E+00	0.0	-2.079E+00
0.055	-2.738E+00	0.0	-3.372E+00
0.060	-3.339E+00	0.0	-4.059E+00
0.065	-3.656E+00	0.0	-4.667E+00
0.070	-3.183E+00	0.0	-4.705E+00
0.075	-2.011E+00	0.0	-3.750E+00
0.080	-1.887E+00	0.0	-3.251E+00
0.085	-1.242E+00	0.0	-3.019E+00
0.090	-2.293E-01	0.0	-2.306E+00
0.095	6.766E-01	0.0	-1.272E+00
0.100	-4.189E-01	0.0	-1.697E+00
0.105	-1.851E+00	0.0	-3.110E+00
0.110	-2.971E+00	0.0	-4.854E+00
0.115	-3.307E+00	0.0	-6.502E+00
0.120	-2.404E+00	0.0	-7.403E+00
0.125	-1.378E+00	0.0	-7.222E+00
0.130	-1.060E-01	0.0	-5.754E+00
0.135	6.672E-01	0.0	-3.186E+00
0.140	4.441E-01	0.0	-1.091E-01
0.145	4.820E-01	0.0	2.595E+00
0.150	2.044E-01	0.0	3.859E+00
0.155	-4.096E-01	0.0	3.647E+00
0.160	-2.580E-01	0.0	2.781E+00

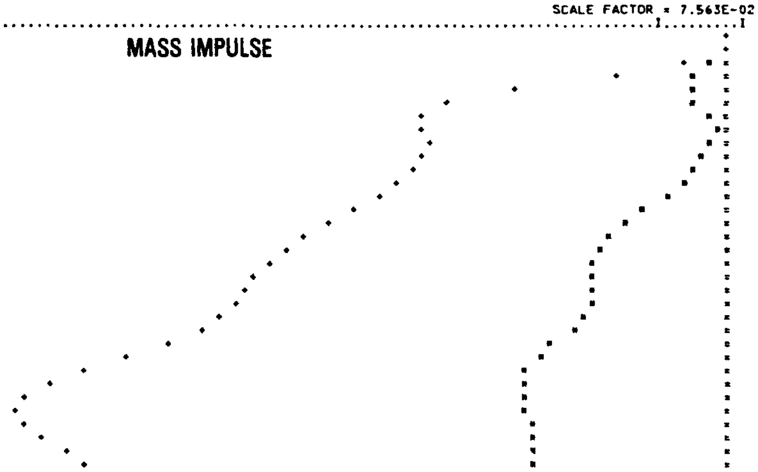
SCALE FACTOR = 2.449E+00



MASS 7 MASS IMPULSES

TIME(SEC)	XIMP *	YIMP x	ZIMP +
0.0	0.0	0.0	0.0
0.005	-3.009E-03	0.0	-3.402E-03
0.010	-1.501E-02	0.0	-3.421E-02
0.015	-2.765E-02	0.0	-1.004E-01
0.020	-3.228E-02	0.0	-1.855E-01
0.025	-2.848E-02	0.0	-2.516E-01
0.030	-1.604E-02	0.0	-2.742E-01
0.035	-1.035E-02	0.0	-2.705E-01
0.040	-1.539E-02	0.0	-2.679E-01
0.045	-2.196E-02	0.0	-2.702E-01
0.050	-2.829E-02	0.0	-2.774E-01
0.055	-3.924E-02	0.0	-2.912E-01
0.060	-5.448E-02	0.0	-3.102E-01
0.065	-7.228E-02	0.0	-3.319E-01
0.070	-8.980E-02	0.0	-3.559E-01
0.075	-1.025E-01	0.0	-3.770E-01
0.080	-1.119E-01	0.0	-3.942E-01
0.085	-1.200E-01	0.0	-4.100E-01
0.090	-1.239E-01	0.0	-4.235E-01
0.095	-1.221E-01	0.0	-4.322E-01
0.100	-1.207E-01	0.0	-4.389E-01
0.105	-1.268E-01	0.0	-4.508E-01
0.110	-1.390E-01	0.0	-4.708E-01
0.115	-1.552E-01	0.0	-4.995E-01
0.120	-1.698E-01	0.0	-5.347E-01
0.125	-1.791E-01	0.0	-5.717E-01
0.130	-1.829E-01	0.0	-6.047E-01
0.135	-1.809E-01	0.0	-6.271E-01
0.140	-1.780E-01	0.0	-6.353E-01
0.145	-1.759E-01	0.0	-6.285E-01
0.150	-1.738E-01	0.0	-6.115E-01
0.155	-1.746E-01	0.0	-5.923E-01
0.160	-1.764E-01	0.0	-5.762E-01

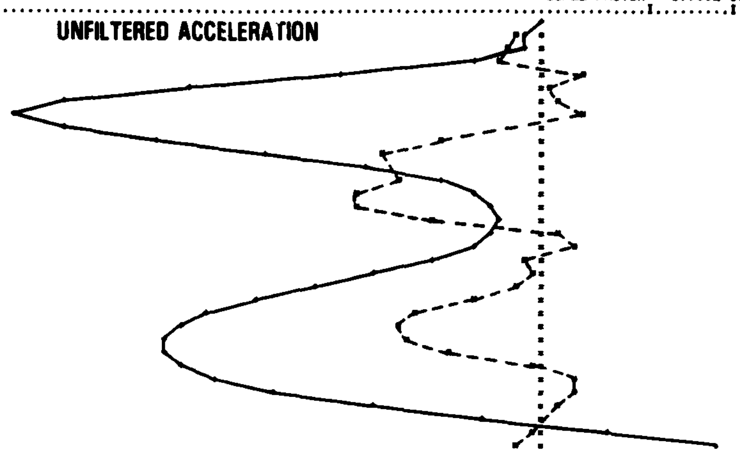
SCALE FACTOR = 7.563E-02



MASS 8 UNFILTERED ACCELERATION(G'S)

TIME(SEC)	XACC *	YACC *	ZACC +
0.0	1.320E-02	0.0	-2.052E-02
0.005	-5.487E-01	0.0	-3.282E-01
0.010	-8.457E-01	0.0	-4.260E-01
0.015	-1.045E+00	0.0	-1.587E+00
0.020	9.613E-01	0.0	-4.535E+00
0.025	9.868E-02	0.0	-8.027E+00
0.030	3.448E-01	0.0	-1.091E+01
0.035	8.869E-01	0.0	-1.199E+01
0.040	-1.017E-02	0.0	-1.092E+01
0.045	-2.306E+00	0.0	-8.795E+00
0.050	-3.679E+00	0.0	-6.287E+00
0.055	-4.099E+00	0.0	-3.923E+00
0.060	-3.338E+00	0.0	-2.372E+00
0.065	-4.247E+00	0.0	-1.617E+00
0.070	-4.252E+00	0.0	-1.234E+00
0.075	-2.435E+00	0.0	-1.055E+00
0.080	4.324E-01	0.0	-1.084E+00
0.085	7.521E-01	0.0	-1.499E+00
0.090	-3.135E-01	0.0	-2.396E+00
0.095	-2.536E-01	0.0	-3.747E+00
0.100	-5.854E-01	0.0	-5.158E+00
0.105	-1.495E+00	0.0	-6.434E+00
0.110	-2.794E+00	0.0	-7.547E+00
0.115	-3.258E+00	0.0	-8.265E+00
0.120	-3.037E+00	0.0	-8.623E+00
0.125	-2.115E+00	0.0	-8.652E+00
0.130	-1.925E 01	0.0	-8.265E+00
0.135	7.199E-01	0.0	-7.446E+00
0.140	8.195E-01	0.0	-6.006E+00
0.145	3.054E-01	0.0	-3.889E+00
0.150	-4.308E-03	0.0	-1.278E+00
0.155	-1.496E-01	0.0	1.488E+00
0.160	-5.241E-01	0.0	3.975E+00

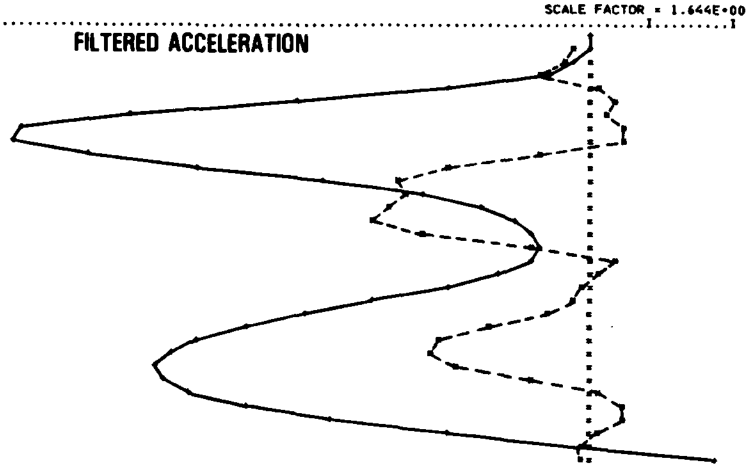
SCALE FACTOR = 1.900E+00



MASS 8 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF *	YACCF *	ZACCF +
0.0	0.0	0.0	0.0
0.005	-3.582E-01	0.0	-1.571E-01
0.010	-5.274E-01	0.0	-3.565E-01
0.015	-1.016E+00	0.0	-8.327E-01
0.020	1.572E-02	0.0	-2.844E+00
0.025	3.937E-01	0.0	-5.900E+00
0.030	1.748E-01	0.0	-9.106E+00
0.035	5.218E-01	0.0	-1.120E+01
0.040	6.127E-01	0.0	-1.142E+01
0.045	-1.124E+00	0.0	-9.999E+00
0.050	-2.817E+00	0.0	-7.818E+00
0.055	-3.790E+00	0.0	-5.395E+00
0.060	-3.634E+00	0.0	-3.596E+00
0.065	-3.950E+00	0.0	-2.179E+00
0.070	-4.342E+00	0.0	-1.527E+00
0.075	-3.376E+00	0.0	-1.190E+00
0.080	-1.228E+00	0.0	-1.083E+00
0.085	4.191E-01	0.0	-1.256E+00
0.090	1.949E-02	0.0	-1.865E+00
0.095	-1.757E-01	0.0	-2.929E+00
0.100	-3.974E-01	0.0	-4.290E+00
0.105	-9.066E-01	0.0	-5.613E+00
0.110	-2.005E+00	0.0	-6.835E+00
0.115	-2.964E+00	0.0	-7.781E+00
0.120	-3.127E+00	0.0	-8.361E+00
0.125	-2.674E+00	0.0	-8.607E+00
0.130	-1.264E+00	0.0	-8.478E+00
0.135	9.540E-02	0.0	-7.935E+00
0.140	6.613E-01	0.0	-6.879E+00
0.145	5.810E-01	0.0	-5.177E+00
0.150	1.256E-01	0.0	-2.885E+00
0.155	-4.642E-02	0.0	-2.350E-01
0.160	-2.876E-01	0.0	2.389E+00

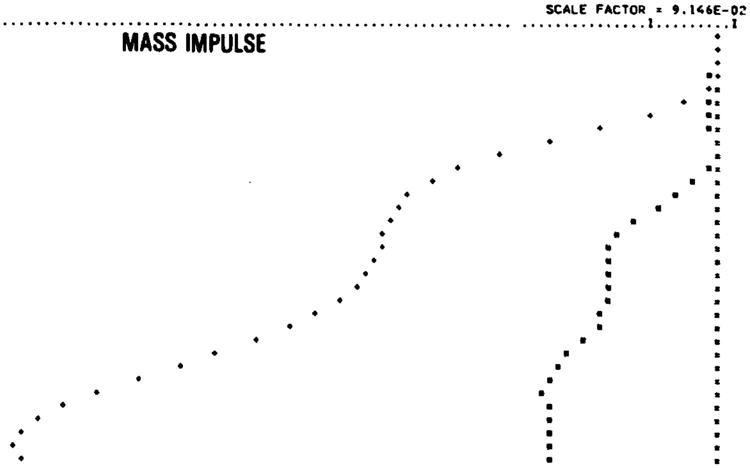
SCALE FACTOR = 1.644E+00



MASS 8 MASS IMPULSES

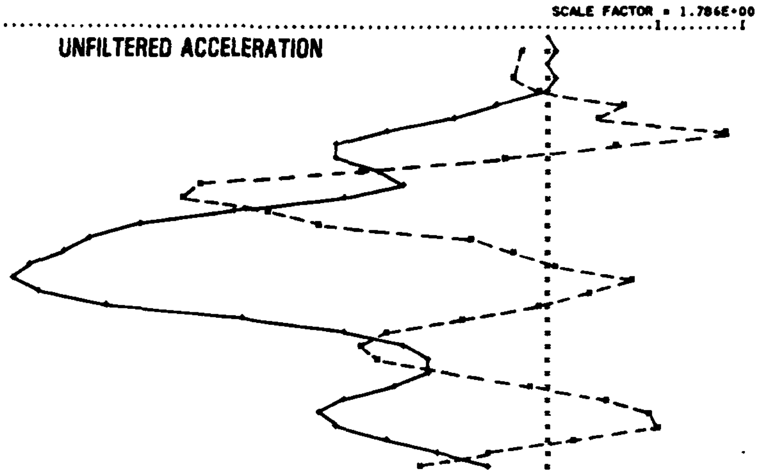
TIME(SEC)	XIMP *	YIMP *	ZIMP +
0.0	0.0	0.0	0.0
0.005	-6.449E-04	0.0	-3.011E-04
0.010	-2.791E-03	0.0	-1.691E-03
0.015	-6.934E-03	0.0	-4.243E-03
0.020	-1.012E-02	0.0	-1.295E-02
0.025	-8.173E-03	0.0	-3.472E-02
0.030	-7.154E-03	0.0	-7.267E-02
0.035	-5.535E-03	0.0	-1.242E-01
0.040	-2.109E-03	0.0	-1.817E-01
0.045	-3.237E-03	0.0	-2.356E-01
0.050	-1.342E-02	0.0	-2.802E-01
0.055	-3.034E-02	0.0	-3.130E-01
0.060	-4.941E-02	0.0	-3.346E-01
0.065	-6.806E-02	0.0	-3.481E-01
0.070	-8.903E-02	0.0	-3.572E-01
0.075	-1.088E-01	0.0	-3.638E-01
0.080	-1.207E-01	0.0	-3.694E-01
0.085	-1.216E-01	0.0	-3.751E-01
0.090	-1.200E-01	0.0	-3.828E-01
0.095	-1.206E-01	0.0	-3.946E-01
0.100	-1.220E-01	0.0	-4.127E-01
0.105	-1.250E-01	0.0	-4.376E-01
0.110	-1.323E-01	0.0	-4.689E-01
0.115	-1.451E-01	0.0	-5.056E-01
0.120	-1.606E-01	0.0	-5.462E-01
0.125	-1.753E-01	0.0	-5.886E-01
0.130	-1.855E-01	0.0	-6.316E-01
0.135	-1.880E-01	0.0	-6.728E-01
0.140	-1.857E-01	0.0	-7.100E-01
0.145	-1.823E-01	0.0	-7.403E-01
0.150	-1.807E-01	0.0	-7.605E-01
0.155	-1.805E-01	0.0	-7.682E-01
0.160	-1.813E-01	0.0	-7.626E-01

SCALE FACTOR = 9.146E-02



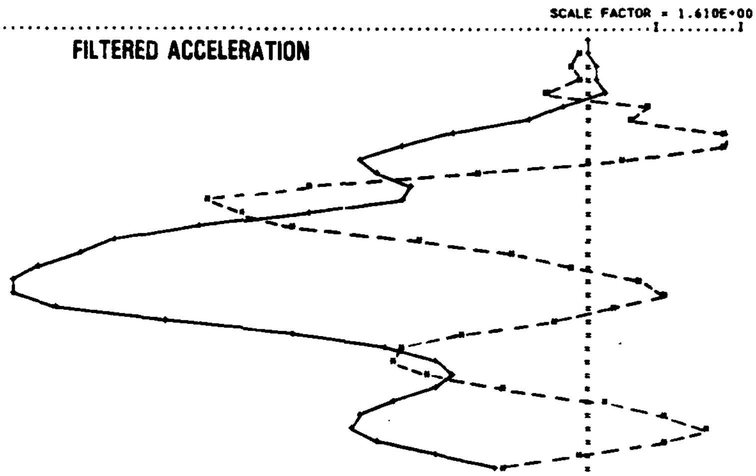
MASS 9 UNFILTERED ACCELERATION(G'S)

TIME(SEC)	XACC	YACC	ZACC
0.0	1.418E-02	0.0	-1.727E-02
0.005	-5.585E-01	0.0	1.521E-01
0.010	2.566E-02	0.0	1.010E-01
0.015	-7.606E-01	0.0	2.875E-01
0.020	-9.860E-02	0.0	3.151E-02
0.025	1.715E+00	0.0	-9.553E-01
0.030	1.070E+00	0.0	-1.927E+00
0.035	3.778E+00	0.0	-3.337E+00
0.040	1.529E+00	0.0	-4.349E+00
0.045	-8.339E-01	0.0	-4.466E+00
0.050	-3.976E+00	0.0	-3.538E+00
0.055	-7.303E+00	0.0	-3.057E+00
0.060	-7.597E+00	0.0	-4.277E+00
0.065	-5.865E+00	0.0	-6.659E+00
0.070	-4.782E+00	0.0	-8.600E+00
0.075	-1.564E+00	0.0	-9.692E+00
0.080	-6.228E-01	0.0	-1.017E+01
0.085	2.726E-01	0.0	-1.078E+01
0.090	1.802E+00	0.0	-1.122E+01
0.095	9.535E-01	0.0	-1.074E+01
0.100	-1.634E-01	0.0	-9.215E+00
0.105	-1.715E+00	0.0	-6.395E+00
0.110	-3.422E+00	0.0	-4.208E+00
0.115	-3.947E+00	0.0	-2.921E+00
0.120	-3.487E+00	0.0	-2.473E+00
0.125	-2.555E+00	0.0	-2.530E+00
0.130	-3.922E-01	0.0	-3.237E+00
0.135	1.241E+00	0.0	-4.226E+00
0.140	2.147E+00	0.0	-4.716E+00
0.145	2.349E+00	0.0	-4.418E+00
0.150	5.074E-01	0.0	-3.397E+00
0.155	-1.162E+00	0.0	-2.246E+00
0.160	-2.597E+00	0.0	-1.178E+00



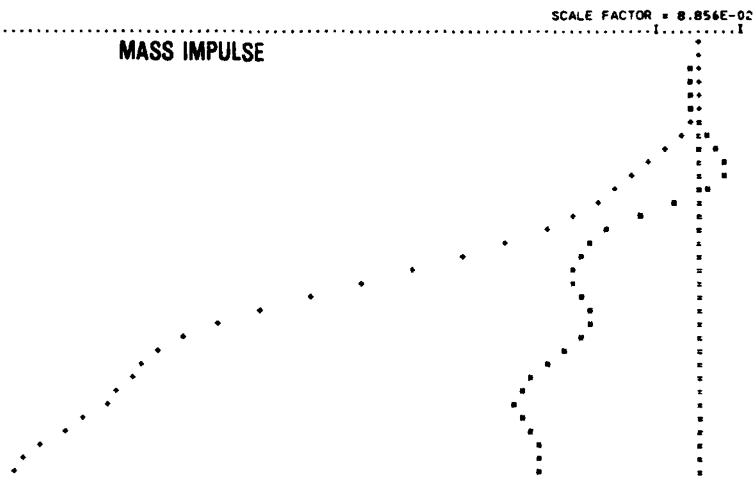
MASS 9 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF	YACCF	ZACCF
0.0	0.0	0.0	0.0
0.005	-1.805E-01	0.0	2.707E-03
0.010	-3.413E-01	0.0	1.524E-01
0.015	-1.392E-01	0.0	1.383E-01
0.020	-8.610E-01	0.0	2.659E-01
0.025	1.161E+00	0.0	-4.981E-01
0.030	8.388E-01	0.0	-1.217E+00
0.035	2.562E+00	0.0	-2.576E+00
0.040	2.493E+00	0.0	-3.634E+00
0.045	5.684E-01	0.0	-4.423E+00
0.050	-2.066E+00	0.0	-3.963E+00
0.055	-5.264E+00	0.0	-3.344E+00
0.060	-7.336E+00	0.0	-3.576E+00
0.065	-6.574E+00	0.0	-5.338E+00
0.070	-5.681E+00	0.0	-7.375E+00
0.075	-3.219E+00	0.0	-8.962E+00
0.080	-1.425E+00	0.0	-9.752E+00
0.085	-3.323E-01	0.0	-1.045E+01
0.090	1.004E+00	0.0	-1.094E+01
0.095	1.407E+00	0.0	-1.096E+01
0.100	4.948E-01	0.0	-1.014E+01
0.105	-6.826E-01	0.0	-8.019E+00
0.110	-2.355E+00	0.0	-5.576E+00
0.115	-3.555E+00	0.0	-3.800E+00
0.120	-3.671E+00	0.0	-2.843E+00
0.125	-3.126E+00	0.0	-2.544E+00
0.130	-1.649E+00	0.0	-2.843E+00
0.135	2.332E-01	0.0	-3.656E+00
0.140	1.463E+00	0.0	-4.402E+00
0.145	2.236E+00	0.0	-4.552E+00
0.150	1.439E+00	0.0	-3.972E+00
0.155	-1.914E-01	0.0	-2.949E+00
0.160	-1.682E+00	0.0	-1.841E+00



MASS 9 MASS IMPULSES

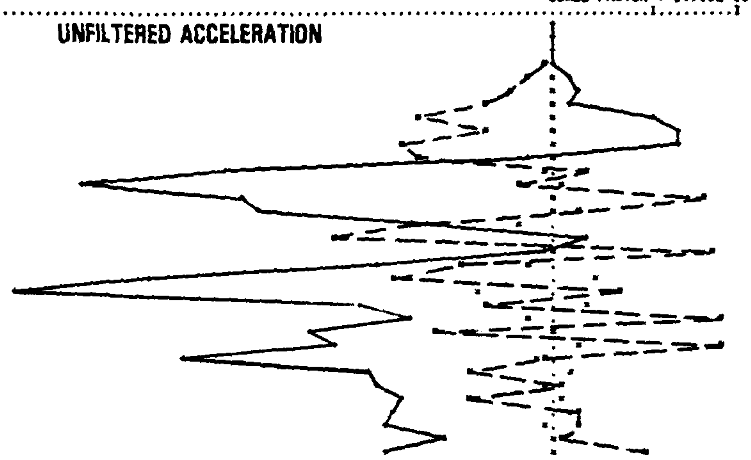
TIME(SEC)	XIMP	YIMP	ZIMP
0.0	0.0	0.0	0.0
0.005	-1.932E-04	0.0	-2.022E-04
0.010	-2.054E-03	0.0	3.476E-04
0.015	-2.544E-03	0.0	9.165E-04
0.020	-6.090E-03	0.0	2.194E-03
0.025	-5.029E-03	0.0	1.703E-03
0.030	1.685E-04	0.0	-2.460E-03
0.035	8.054E-03	0.0	-1.202E-02
0.040	2.224E-02	0.0	-2.763E-02
0.045	3.003E-02	0.0	-4.829E-02
0.050	2.647E-02	0.0	-6.952E-02
0.055	8.063E-03	0.0	-8.767E-02
0.060	-2.475E-02	0.0	-1.043E-01
0.065	-6.012E-02	0.0	-1.263E-01
0.070	-9.078E-02	0.0	-1.583E-01
0.075	-1.134E-01	0.0	-1.996E-01
0.080	-1.243E-01	0.0	-2.466E-01
0.085	-1.284E-01	0.0	-2.972E-01
0.090	-1.270E-01	0.0	-3.506E-01
0.095	-1.200E-01	0.0	-4.057E-01
0.100	-1.152E-01	0.0	-4.588E-01
0.105	-1.155E-01	0.0	-5.046E-01
0.110	-1.237E-01	0.0	-5.382E-01
0.115	-1.385E-01	0.0	-5.612E-01
0.120	-1.570E-01	0.0	-5.774E-01
0.125	-1.741E-01	0.0	-5.906E-01
0.130	-1.865E-01	0.0	-6.039E-01
0.135	-1.897E-01	0.0	-6.200E-01
0.140	-1.852E-01	0.0	-6.404E-01
0.145	-1.755E-01	0.0	-6.631E-01
0.150	-1.657E-01	0.0	-6.847E-01
0.155	-1.626E-01	0.0	-7.020E-01
0.160	-1.674E-01	0.0	-7.159E-01



MASS 11 UNFILTERED ACCELERATION(G'S)

SCALE FACTOR = 5.715E+00

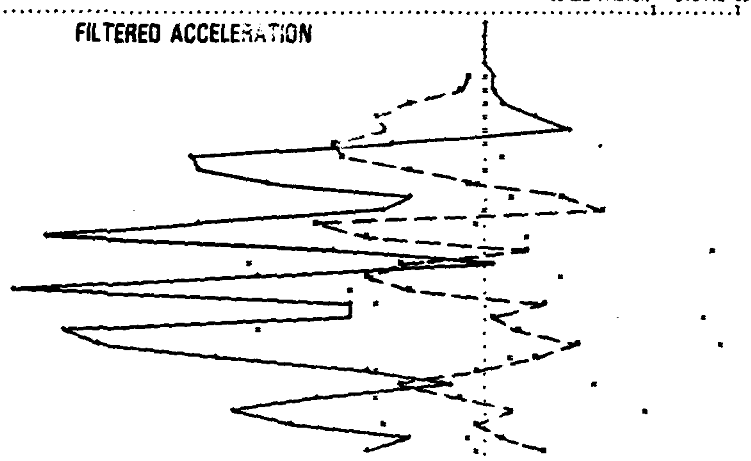
TIME(SEC)	XACC *	YACC ■	ZACC +
0.0	1.294E-02	-5.773E-05	-3.655E-02
0.005	-1.719E-02	6.171E-03	-3.374E-02
0.010	-9.650E-02	8.825E-03	2.222E-01
0.015	-3.750E-01	4.434E-03	9.875E-02
0.020	-1.029E+00	-1.399E-02	6.873E-01
0.025	-1.955E+00	1.124E-02	1.328E+00
0.030	-2.800E+00	-1.049E-01	8.859E-01
0.035	-5.898E+00	9.558E-02	4.345E+00
0.040	-2.968E+00	1.637E-01	5.787E+00
0.045	-6.707E+00	1.802E-01	5.628E+00
0.050	-5.905E+00	-5.978E-02	-1.242E+00
0.055	1.373E+00	-2.237E-01	-1.434E+01
0.060	-1.572E+00	5.068E-01	-2.070E+01
0.065	6.591E+00	2.040E-01	-1.352E+01
0.070	1.132E+00	2.258E-01	-1.294E+01
0.075	-6.197E+00	-1.491E+00	-5.502E+00
0.080	-9.726E+00	1.715E+00	1.380E+00
0.085	7.251E+00	1.091E-01	-3.305E-01
0.090	-4.132E+00	-1.205E+00	-7.650E+00
0.095	-6.977E+00	2.084E+00	-1.767E+01
0.100	2.858E+00	-3.295E+00	-2.371E+01
0.105	-2.905E+00	1.520E+00	-8.587E+00
0.110	7.336E+00	-9.852E-01	-6.338E+00
0.115	-5.157E+00	-1.654E-02	-1.083E+01
0.120	7.483E+00	1.195E+00	-9.552E+00
0.125	-1.516E-01	-6.438E-01	-1.619E+01
0.130	-3.826E+00	7.551E-01	-7.966E+00
0.135	4.676E-01	-1.311E-01	-7.561E+00
0.140	-3.502E+00	2.602E-01	-6.702E+00
0.145	1.228E+00	7.363E-01	-7.106E+00
0.150	1.156E+00	-1.933E-01	-7.305E+00
0.155	3.864E-01	1.016E-01	-4.883E+00
0.160	3.994E+00	-1.823E-02	-7.413E+00



MASS 12 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 3.044E+00

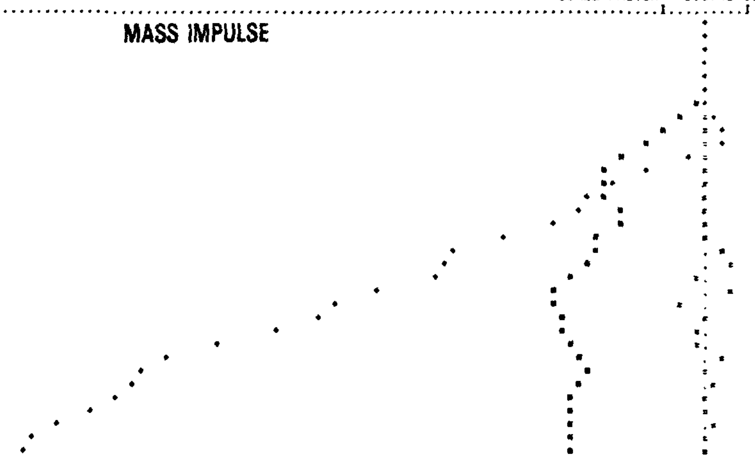
TIME(SEC)	XACCF #	YACCF ■	ZACCF •
0.0	0.0	0.0	0.0
0.005	6.878E-03	6.711E-04	-2.554E-02
0.010	-1.001E-02	-3.630E-03	-1.648E-02
0.015	-1.390E-01	-3.348E-04	-1.859E-03
0.020	-6.939E-01	-4.128E-03	4.948E-02
0.025	-1.142E+00	1.608E-02	2.001E-01
0.030	-2.755E+00	-2.699E-02	4.642E-01
0.035	-4.185E+00	2.024E-03	1.624E+00
0.040	-3.756E+00	-8.078E-02	2.935E+00
0.045	-5.584E+00	-1.691E-02	-3.602E+00
0.050	-5.336E+00	3.530E-01	-1.088E+01
0.055	-2.905E+00	-1.858E-01	-1.055E+01
0.060	-8.468E-01	-3.817E-01	-8.173E+00
0.065	2.614E+00	6.690E-01	-2.949E+00
0.070	4.274E+00	-1.806E-01	-3.662E+00
0.075	-6.172E+00	-3.846E-01	-1.044E+01
0.080	-4.407E+00	1.282E+00	-1.588E+01
0.085	1.495E+00	8.083E+00	-5.543E+00
0.090	-3.152E+00	-8.683E+00	2.484E-01
0.095	-4.510E+00	2.642E+00	-8.463E+00
0.100	-2.990E+00	-4.882E+00	-1.717E+01
0.105	2.104E+00	-4.104E+00	-4.959E+00
0.110	9.326E-02	7.719E+00	-4.941E+00
0.115	9.581E-01	-8.207E+00	-1.532E+01
0.120	3.361E+00	8.404E+00	-1.409E+01
0.125	1.814E+00	9.097E-01	-9.716E+00
0.130	-4.078E-01	-3.988E+00	-4.344E+00
0.135	-3.197E+00	3.713E+00	-1.376E+00
0.140	-1.099E+00	-3.936E+00	-6.285E+00
0.145	8.542E-01	5.746E+00	-9.361E+00
0.150	-4.781E-01	-3.697E+00	-7.143E+00
0.155	4.074E-01	-7.565E-01	-2.916E+00
0.160	1.943E+00	-2.728E-01	-4.467E+00



MASS 12 MASS IMPULSES

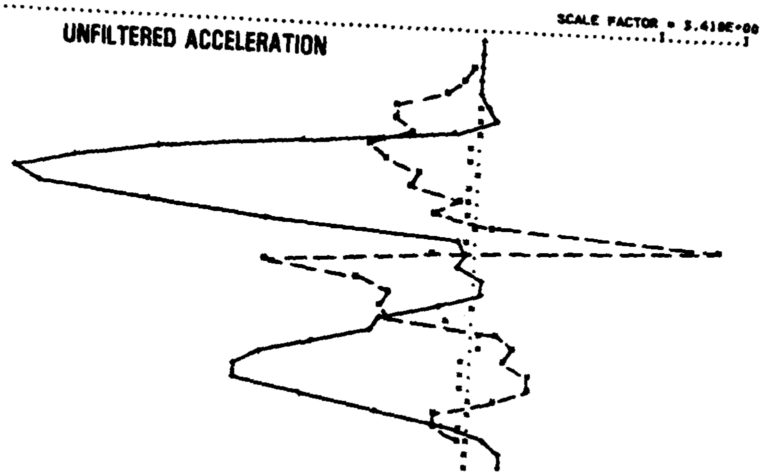
SCALE FACTOR = 1.074E-01

TIME(SEC)	XIMP #	YIMP ■	ZIMP •
0.0	0.0	0.0	0.0
0.005	2.932E-05	1.617E-06	-7.760E-05
0.010	1.834E-05	-2.577E-06	-1.982E-04
0.015	-2.043E-04	-2.170E-05	-2.292E-04
0.020	-2.388E-03	-1.782E-05	-1.774E-04
0.025	-6.594E-03	-1.143E-05	4.697E-04
0.030	-1.651E-02	7.448E-06	1.985E-03
0.035	-3.397E-02	-1.149E-04	6.766E-03
0.040	-5.434E-02	-3.090E-04	1.871E-02
0.045	-7.616E-02	-3.642E-04	2.281E-02
0.050	-1.058E-01	1.480E-04	-1.912E-02
0.055	-1.262E-01	1.392E-03	-7.407E-02
0.060	-1.361E-01	-1.089E-03	-1.218E-01
0.065	-1.318E-01	1.700E-04	-1.490E-01
0.070	-1.119E-01	1.907E-03	-1.621E-01
0.075	-1.101E-01	-4.031E-04	-1.948E-01
0.080	-1.459E-01	1.836E-03	-2.665E-01
0.085	-1.649E-01	2.403E-02	-3.244E-01
0.090	-1.502E-01	3.016E-02	-3.301E-01
0.095	-1.715E-01	-1.651E-02	-3.435E-01
0.100	-1.918E-01	2.949E-02	-4.199E-01
0.105	-1.920E-01	-3.713E-02	-4.777E-01
0.110	-1.853E-01	2.781E-03	-4.911E-01
0.115	-1.858E-01	-1.695E-02	-5.488E-01
0.120	-1.730E-01	-1.509E-02	-6.247E-01
0.125	-1.596E-01	1.965E-02	-6.866E-01
0.130	-1.558E-01	-2.077E-03	-7.206E-01
0.135	-1.658E-01	5.055E-03	-7.307E-01
0.140	-1.786E-01	2.942E-03	-7.494E-01
0.145	-1.771E-01	9.931E-04	-7.894E-01
0.150	-1.763E-01	1.215E-02	-8.324E-01
0.155	-1.772E-01	-6.555E-03	-8.565E-01
0.160	-1.713E-01	-2.415E-03	-8.720E-01



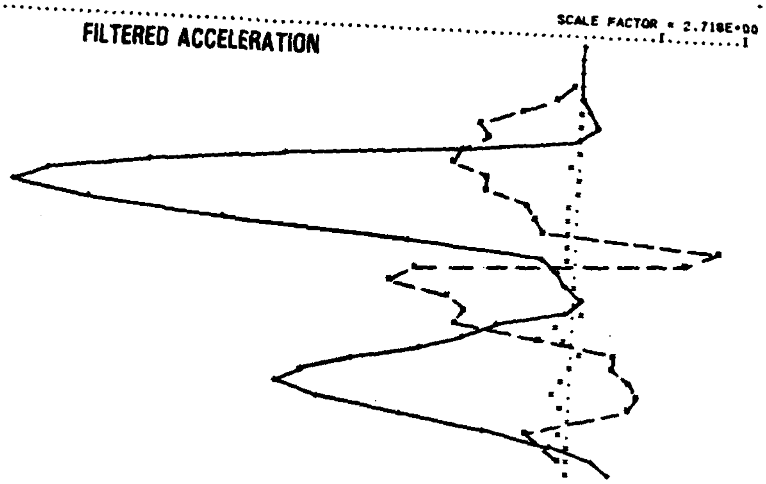
MASS 13 UNFILTERED ACCELERATION(G'S)

TIME(SEC)	XACC	YACC	ZACC
0.0	1.240E-02	-1.465E-04	-3.160E-02
0.005	-3.602E-03	2.923E-04	-1.913E-02
0.010	-7.372E-02	-3.932E-03	-1.602E-02
0.015	-5.071E-01	2.487E-03	-2.853E-02
0.020	-1.067E+00	-1.905E-02	2.409E-01
0.025	-3.149E+00	-9.608E-04	5.708E-01
0.030	-3.400E+00	6.198E-02	8.929E-01
0.035	-2.539E+00	9.469E-02	-1.008E+00
0.040	-4.239E+00	-5.965E-02	-7.037E+00
0.045	-3.680E+00	-1.007E-01	-1.270E+01
0.050	-2.370E+00	8.109E-02	-1.627E+01
0.055	-2.467E+00	-5.657E-02	-1.862E+01
0.060	-6.436E-01	-1.950E-01	-1.777E+01
0.065	-1.535E+00	-1.237E-01	-1.326E+01
0.070	6.698E-01	1.069E-03	-8.394E+00
0.075	1.002E+01	-6.916E-02	-3.870E-01
0.080	-1.597E+00	-3.546E-01	-2.581E-01
0.085	-8.323E+00	-5.163E-01	-5.591E-01
0.090	-4.663E+00	3.547E-01	4.113E-01
0.095	-3.115E+00	3.769E-01	5.275E-01
0.100	-3.452E+00	-1.391E-02	-1.345E+00
0.105	-3.362E+00	-7.738E-01	-3.698E+00
0.110	1.114E+00	3.873E-01	-3.852E+00
0.115	1.982E+00	4.148E-01	-6.386E+00
0.120	1.438E+00	-1.966E-01	-8.337E+00
0.125	2.364E+00	-3.327E-01	-9.563E+00
0.130	2.385E+00	-3.422E-01	-9.258E+00
0.135	1.099E+00	1.922E-01	-6.571E+00
0.140	-1.248E+00	6.881E-02	-3.754E+00
0.145	-1.250E+00	-1.495E-01	-1.023E+00
0.150	-6.445E-02	9.201E-02	7.021E-01
0.155	6.387E-02	2.029E-01	1.372E+00
0.160	9.868E-02	1.692E-01	1.586E+00



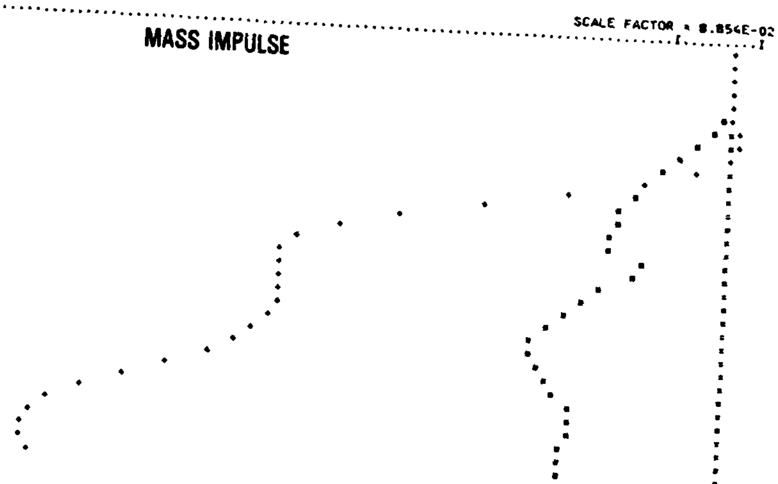
MASS 13 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF	YACCF	ZACCF
0.0	0.0	0.0	0.0
0.005	5.185E-03	1.385E-04	-2.036E-02
0.010	-2.372E-02	-1.422E-03	-1.233E-02
0.015	-2.370E-01	-2.399E-03	-2.912E-02
0.020	-7.583E-01	-4.929E-03	8.451E-02
0.025	-1.842E+00	-1.291E-02	3.464E-01
0.030	-3.158E+00	3.074E-02	7.261E-01
0.035	-2.961E+00	7.723E-02	8.159E-02
0.040	-3.595E+00	3.084E-02	-3.662E+00
0.045	-3.907E+00	-8.591E-02	-9.323E+00
0.050	-2.787E+00	-6.463E-04	-1.378E+01
0.055	-2.885E+00	1.755E-02	-1.713E+01
0.060	-1.582E+00	-1.294E-01	-1.813E+01
0.065	-1.188E+00	-1.479E-01	-1.580E+01
0.070	-9.659E-01	-5.801E-02	-1.124E+01
0.075	4.700E+00	-7.790E-02	-5.316E+00
0.080	3.689E+00	-1.298E-01	-9.473E-01
0.085	-5.040E+00	-5.406E-01	-5.349E-01
0.090	-6.003E+00	-4.594E-02	-7.826E-02
0.095	-3.918E+00	3.000E-01	2.217E-01
0.100	-3.449E+00	2.755E-01	-1.634E-01
0.105	-3.736E+00	-4.695E-01	-2.402E+00
0.110	-1.125E+00	-1.498E-01	-3.583E+00
0.115	1.397E+00	3.924E-01	-4.892E+00
0.120	1.494E+00	7.064E-02	-7.070E+00
0.125	1.891E+00	-2.122E-01	-8.749E+00
0.130	2.332E+00	-3.437E-01	-9.446E+00
0.135	1.941E+00	-8.505E-02	-7.992E+00
0.140	3.636E-02	1.311E-01	-5.392E+00
0.145	-1.171E+00	-8.207E-02	-2.767E+00
0.150	-5.824E-01	-5.405E-03	-4.421E-01
0.155	-1.012E-01	1.293E-01	8.575E-01
0.160	1.640E-02	1.861E-01	1.407E+00



MASS 13 MASS IMPULSES

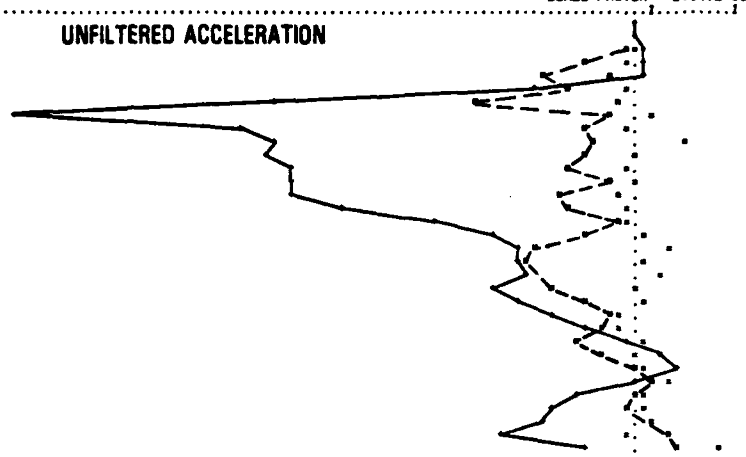
TIME(SEC)	XIMP	YIMP	ZIMP
0.0	0.0	0.0	0.0
0.005	2.702E-05	-1.186E-07	-6.731E-05
0.010	4.135E-06	-1.657E-06	-1.436E-04
0.015	-5.099E-04	-1.680E-05	-2.477E-04
0.020	-3.078E-03	-2.605E-05	-2.209E-04
0.025	-9.000E-03	-9.352E-05	8.529E-04
0.030	-2.235E-02	-6.026E-05	3.581E-03
0.035	-3.833E-02	2.110E-04	6.461E-03
0.040	-5.381E-02	5.477E-04	-4.374E-04
0.045	-7.298E-02	3.506E-04	-3.367E-02
0.050	-8.987E-02	7.321E-05	-9.224E-02
0.055	-1.042E-01	-2.277E-04	-1.705E-01
0.060	-1.156E-01	-4.922E-05	-2.600E-01
0.065	-1.215E-01	-8.243E-04	-3.461E-01
0.070	-1.286E-01	-1.372E-03	-4.134E-01
0.075	-1.228E-01	-1.662E-03	-4.564E-01
0.080	-9.484E-02	-2.024E-03	-4.687E-01
0.085	-1.008E-01	-3.906E-03	-4.722E-01
0.090	-1.318E-01	-5.581E-03	-4.747E-01
0.095	-1.561E-01	-4.675E-03	-4.739E-01
0.100	-1.740E-01	-3.012E-03	-4.727E-01
0.105	-1.923E-01	-3.526E-03	-4.792E-01
0.110	-2.055E-01	-5.442E-03	-4.950E-01
0.115	-2.035E-01	-4.635E-03	-5.154E-01
0.120	-1.959E-01	-3.306E-03	-5.457E-01
0.125	-1.878E-01	-3.780E-03	-5.856E-01
0.130	-1.769E-01	-5.252E-03	-6.318E-01
0.135	-1.657E-01	-6.507E-03	-6.761E-01
0.140	-1.605E-01	-6.158E-03	-7.095E-01
0.145	-1.643E-01	-6.029E-03	-7.298E-01
0.150	-1.690E-01	-6.349E-03	-7.373E-01
0.155	-1.705E-01	-6.014E-03	-7.357E-01
0.160	-1.706E-01	-5.159E-03	-7.298E-01



MASS 14 UNFILTERED ACCELERATION(G'S)

T.ME(SEC)	XACC *	YACC *	ZACC *
0.0	1.277E-02	-2.443E-04	-3.096E-02
0.005	-9.452E-02	7.684E-04	1.738E-02
0.010	-3.058E-01	-9.787E-03	9.884E-02
0.015	-1.249E+00	-3.372E-01	1.708E-01
0.020	-2.338E+00	-6.733E-01	2.181E-01
0.025	-1.649E+00	-2.690E-01	-2.653E+00
0.030	-4.135E+00	-4.504E-01	-9.369E+00
0.035	-5.953E-01	6.046E-01	-1.592E+01
0.040	-1.351E+00	-2.069E-01	-1.017E+01
0.045	-1.108E+00	1.282E+00	-9.356E+00
0.050	-1.343E+00	-3.081E-02	-9.515E+00
0.055	-1.665E+00	-2.835E-01	-8.769E+00
0.060	-6.177E-01	-6.225E-02	-8.767E+00
0.065	-1.942E+00	-5.480E-01	-8.864E+00
0.070	-1.736E+00	-1.585E-01	-7.480E+00
0.075	-4.289E-01	-1.798E-01	-5.274E+00
0.080	-1.310E+00	2.338E-01	-3.580E+00
0.085	-2.631E+00	9.100E-01	-3.107E+00
0.090	-2.867E+00	2.725E-01	-2.970E+00
0.095	-2.905E+00	6.762E-01	-2.878E+00
0.100	-2.077E+00	4.490E-02	-3.619E+00
0.105	-1.241E+00	2.467E-01	-2.994E+00
0.110	-5.964E-01	-4.047E-01	-2.216E+00
0.115	-8.001E-01	-3.539E-01	-1.291E+00
0.120	-1.523E+00	1.546E-01	-3.109E-01
0.125	-9.183E-01	-1.290E-01	5.215E-01
0.130	2.294E-02	1.237E-01	1.073E+00
0.135	3.320E-01	8.767E-01	-5.487E-02
0.140	-7.840E-02	1.643E-01	-1.501E+00
0.145	-2.261E-01	1.454E-01	-2.113E+00
0.150	4.760E-01	3.224E-01	-2.418E+00
0.155	9.218E-01	-2.884E-01	-3.563E+00
0.160	1.029E+00	2.125E+00	-1.222E+00

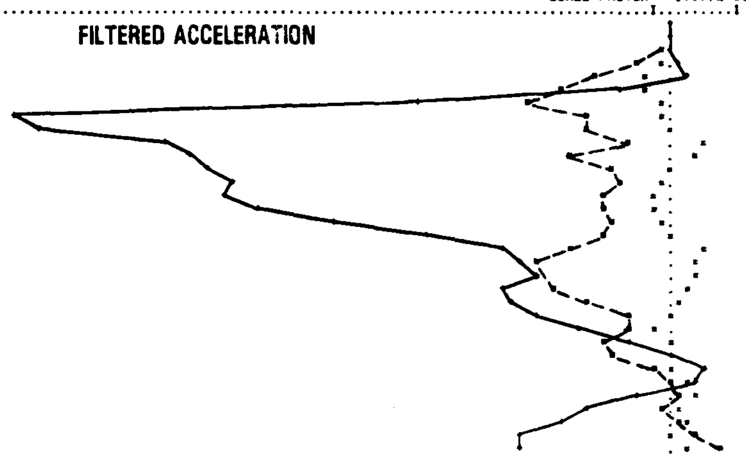
SCALE FACTOR = 2.149E+00



MASS 14 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF *	YACCF *	ZACCF *
0.0	0.0	0.0	0.0
0.005	-3.067E-02	4.333E-03	-6.450E-03
0.010	-1.841E-01	1.029E-02	5.958E-02
0.015	-7.120E-01	-1.134E-01	9.402E-02
0.020	-1.538E+00	-5.411E-01	3.380E-01
0.025	-2.178E+00	-5.279E-01	-1.016E+00
0.030	-2.943E+00	-2.153E-01	-5.039E+00
0.035	-1.695E+00	-2.515E-01	-1.310E+01
0.040	-1.622E+00	-2.273E-02	-1.255E+01
0.045	-8.241E-01	5.754E-01	-1.003E+01
0.050	-2.066E+00	5.710E-01	-9.534E+00
0.055	-1.159E+00	-9.615E-02	-9.193E+00
0.060	-1.008E+00	-1.014E-01	-8.767E+00
0.065	-1.398E+00	-3.815E-01	-8.843E+00
0.070	-1.352E+00	-3.019E-01	-8.287E+00
0.075	-1.203E+00	-2.384E-01	-6.650E+00
0.080	-1.347E+00	-7.705E-03	-4.796E+00
0.085	-2.057E+00	6.639E-01	-3.417E+00
0.090	-2.713E+00	4.420E-01	-2.960E+00
0.095	-2.780E+00	5.147E-01	-2.747E+00
0.100	-2.392E+00	3.185E-01	-3.374E+00
0.105	-1.708E+00	1.928E-01	-3.212E+00
0.110	-8.997E-01	-4.211E-02	-2.696E+00
0.115	-7.897E-01	-4.109E-01	-1.854E+00
0.120	-1.339E+00	-6.524E-02	-8.601E-01
0.125	-1.115E+00	-3.654E-02	-1.650E-03
0.130	-3.950E-01	-1.636E-02	7.124E-01
0.135	5.544E-02	3.653E-01	5.516E-01
0.140	8.799E-02	4.787E-01	-7.234E-01
0.145	-1.330E-01	1.341E-01	-1.647E+00
0.150	9.919E-02	3.063E-01	-2.213E+00
0.155	5.509E-01	-1.399E-02	-2.959E+00
0.160	9.922E-01	4.038E-01	-2.991E+00

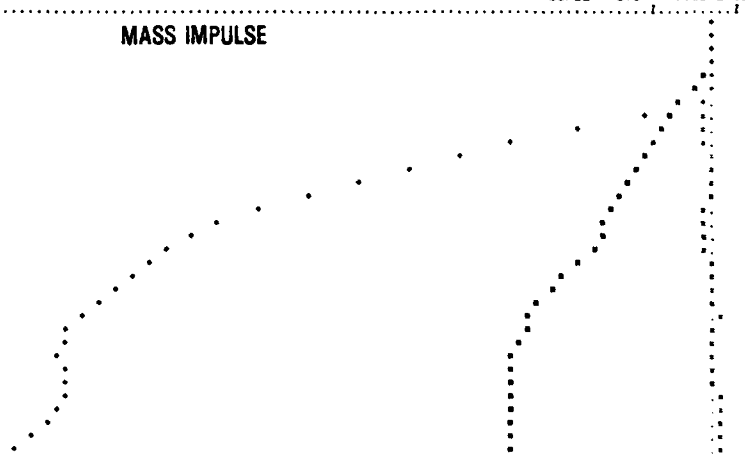
SCALE FACTOR = 1.677E+00



MASS 14 MASS IMPULSES

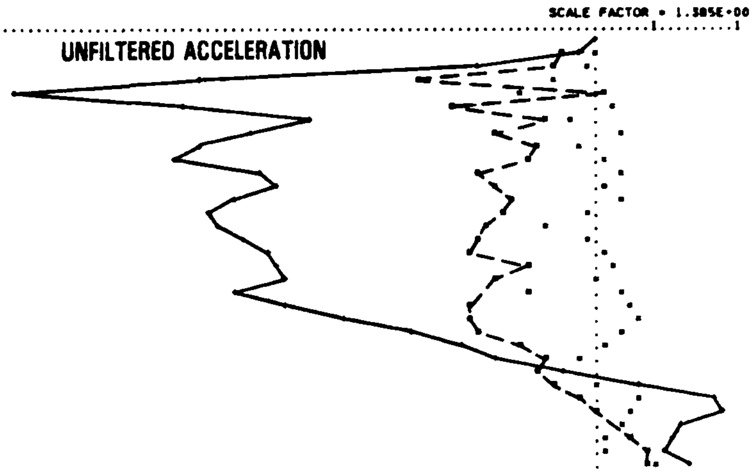
TIME(SEC)	XIMP *	YIMP *	ZIMP *
0.0	0.0	0.0	0.0
0.005	-1.826E-05	1.947E-05	-2.942E-05
0.010	-5.226E-04	6.419E-05	8.832E-05
0.015	-2.445E-03	-9.568E-05	4.738E-04
0.020	-7.882E-03	-1.853E-03	1.682E-03
0.025	-1.813E-02	-4.762E-03	8.831E-04
0.030	-2.927E-02	-6.239E-03	-1.244E-02
0.035	-4.226E-02	-8.069E-03	-5.868E-02
0.040	-4.994E-02	-7.998E-03	-1.265E-01
0.045	-5.597E-02	-7.281E-03	-1.815E-01
0.050	-6.386E-02	-3.437E-03	-2.298E-01
0.055	-7.047E-02	-2.619E-03	-2.769E-01
0.060	-7.665E-02	-3.302E-03	-3.214E-01
0.065	-8.198E-02	-4.356E-03	-3.655E-01
0.070	-8.904E-02	-6.255E-03	-4.090E-01
0.075	-9.666E-02	-7.518E-03	-4.466E-01
0.080	-1.024E-01	-8.211E-03	-4.748E-01
0.085	-1.106E-01	-6.589E-03	-4.945E-01
0.090	-1.226E-01	-3.570E-03	-5.101E-01
0.095	-1.360E-01	-1.444E-03	-5.243E-01
0.100	-1.491E-01	9.626E-04	-5.396E-01
0.105	-1.593E-01	1.988E-03	-5.565E-01
0.110	-1.657E-01	2.653E-03	-5.714E-01
0.115	-1.697E-01	1.187E-03	-5.827E-01
0.120	-1.748E-01	-9.808E-05	-5.894E-01
0.125	-1.811E-01	-1.315E-04	-5.915E-01
0.130	-1.852E-01	-4.418E-04	-5.895E-01
0.135	-1.861E-01	1.636E-04	-5.856E-01
0.140	-1.854E-01	2.890E-03	-5.860E-01
0.145	-1.856E-01	4.161E-03	-5.922E-01
0.150	-1.860E-01	5.272E-03	-6.021E-01
0.155	-1.843E-01	6.202E-03	-6.149E-01
0.160	-1.802E-01	5.909E-03	-6.313E-01

SCALE FACTOR = 7.589E-02



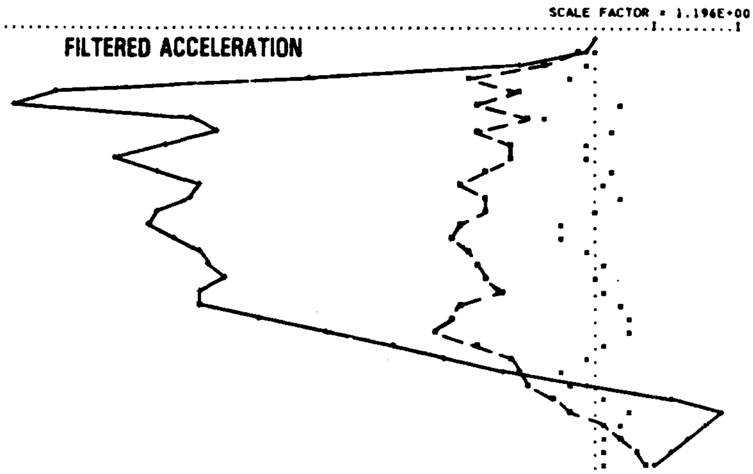
MASS 15 UNFILTERED ACCELERATION(G'S)

TIME(SEC)	XACC	YACC	ZACC
0.0	1.296E-02	-1.525E-04	-2.777E-02
0.005	-6.111E-01	-4.255E-03	-2.587E-01
0.010	-7.660E-01	-1.553E-01	-1.914E+00
0.015	-2.974E+00	-7.131E-01	-6.541E+00
0.020	1.776E-01	-1.296E+00	-9.586E+00
0.025	-2.368E+00	2.605E-01	-6.828E+00
0.030	-8.738E-01	-4.587E-01	-4.721E+00
0.035	-1.625E+00	4.274E-01	-5.709E+00
0.040	-9.665E-01	-2.951E-01	-6.571E+00
0.045	-1.158E+00	5.777E-02	-6.887E+00
0.050	-1.966E+00	4.128E-01	-5.613E+00
0.055	-1.758E+00	1.144E-01	-5.354E+00
0.060	-1.435E+00	4.306E-01	-5.955E+00
0.065	-1.540E+00	-2.010E-01	-6.370E+00
0.070	-1.861E+00	-7.918E-01	-6.218E+00
0.075	-1.987E+00	-1.843E-01	-5.810E+00
0.080	-2.066E+00	8.942E-02	-5.371E+00
0.085	-1.097E+00	2.365E-01	-5.243E+00
0.090	-1.759E+00	2.080E-02	-5.164E+00
0.095	-1.115E+00	4.217E-01	-5.949E+00
0.100	-2.172E+00	4.860E-01	-5.146E+00
0.105	-2.145E+00	6.031E-01	-4.225E+00
0.110	-2.016E+00	3.298E-01	-3.145E+00
0.115	-1.297E+00	4.943E-02	-2.241E+00
0.120	-8.738E-01	-2.813E-01	-1.626E+00
0.125	-1.014E+00	-6.065E-01	-5.601E-01
0.130	-7.091E-01	-9.744E-02	6.885E-01
0.135	-3.238E-01	6.072E-01	1.946E+00
0.140	3.483E-03	5.304E-01	2.048E+00
0.145	3.918E-01	3.352E-01	1.327E+00
0.150	5.411E-01	6.256E-02	1.232E+00
0.155	7.636E-01	1.551E-01	1.032E+00
0.160	8.270E-01	9.348E-01	1.458E+00



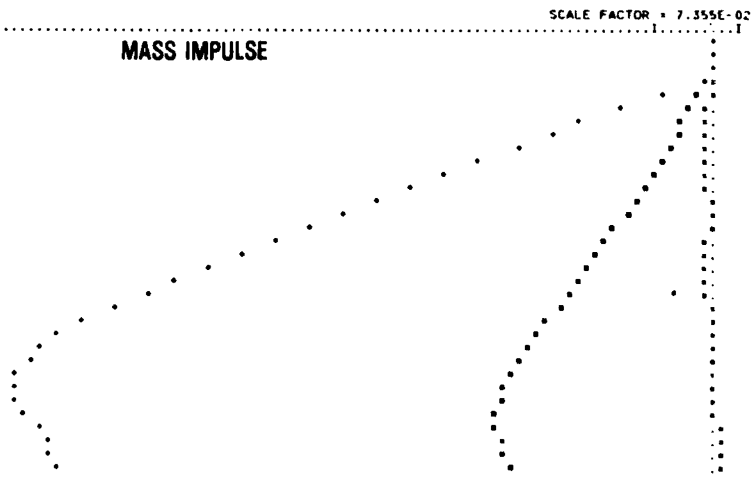
MASS 15 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF	YACCF	ZACCF
0.0	0.0	0.0	0.0
0.005	-2.284E-01	-3.601E-06	-6.700E-02
0.010	-7.164E-01	-6.243E-02	-1.032E+00
0.015	-1.795E+00	-3.245E-01	-3.971E+00
0.020	-1.012E+00	-1.172E+00	-7.584E+00
0.025	-1.601E+00	3.519E-01	-8.206E+00
0.030	-8.584E-01	-6.682E-01	-5.658E+00
0.035	-1.601E+00	2.940E-01	-5.342E+00
0.040	-1.159E+00	-8.278E-02	-6.031E+00
0.045	-1.169E+00	-1.028E-01	-6.767E+00
0.050	-1.502E+00	2.927E-01	-6.212E+00
0.055	-1.895E+00	1.341E-01	-5.537E+00
0.060	-1.467E+00	3.726E-01	-5.655E+00
0.065	-1.490E+00	9.518E-02	-6.124E+00
0.070	-1.893E+00	-4.561E-01	-6.331E+00
0.075	-2.037E+00	-4.619E-01	-5.984E+00
0.080	-1.782F+00	-1.209E-01	-5.630E+00
0.085	-1.571E+00	1.895E-01	-5.430F+00
0.090	-1.535E+00	7.572E-02	-5.164E+00
0.095	-1.271E+00	2.235E-01	-5.622E+00
0.100	-1.839E+00	4.493E-01	-5.583E+00
0.105	-2.042E+00	5.071E-01	-4.741E+00
0.110	-2.185E+00	5.057E-01	-3.779E+00
0.115	-1.581E+00	1.875E-01	-2.806E+00
0.120	-1.196E+00	-4.424E-02	-2.087E+00
0.125	-9.879E-01	-6.513E-01	-1.221E+00
0.130	-9.335E-01	-3.495E-01	-6.760E-02
0.135	-5.379E-01	2.199E-01	1.151E+00
0.140	-2.924E-01	5.485E-01	1.843E+00
0.145	2.030E-01	4.198E-01	1.624E+00
0.150	4.140E-01	2.207E-01	1.328E+00
0.155	6.443E-01	1.108E-01	1.171E+00
0.160	7.803E-01	2.129E-01	9.234E-01



MASS 15 MASS IMPULSES

TIME(SEC)	XIMP	YIMP	ZIMP
0.0	0.0	0.0	0.0
0.005	-2.574E-04	-4.108E-06	-1.201E-04
0.010	-2.902E-03	-1.040E-04	-2.431E-03
0.015	-7.999E-03	-9.271E-04	-1.232E-02
0.020	-1.693E-02	-4.862E-03	-4.310E-02
0.025	-2.207E-02	-6.673E-03	-8.497E-02
0.030	-2.882E-02	-7.874E-03	-1.190E-01
0.035	-3.524E-02	-8.621E-03	-1.456E-01
0.040	-4.227E-02	-7.932E-03	-1.740E-01
0.045	-4.798E-02	-8.621E-03	-2.063E-01
0.050	-5.428E-02	-8.114E-03	-2.392E-01
0.055	-6.320E-02	-6.955E-03	-2.682E-01
0.060	-7.147E-02	-5.728E-03	-2.958E-01
0.065	-7.887E-02	-4.351E-03	-3.253E-01
0.070	-8.739E-02	-5.241E-03	-3.567E-01
0.075	-9.706E-02	-7.992E-03	-3.875E-01
0.080	-1.062E-01	-9.353E-03	-4.166E-01
0.085	-1.152E-01	-9.054E-03	-4.442E-01
0.090	-1.225E-01	-8.333E-03	-4.705E-01
0.095	-1.299E-01	-7.754E-03	-4.972E-01
0.100	-1.374E-01	-5.963E-03	-5.257E-01
0.105	-1.472E-01	-3.604E-03	-5.515E-01
0.110	-1.580E-01	-8.719E-04	-5.728E-01
0.115	-1.674E-01	7.992E-04	-5.892E-01
0.120	-1.744E-01	1.213E-03	-6.013E-01
0.125	-1.796E-01	-1.079E-04	-6.096E-01
0.130	-1.845E-01	-2.378E-03	-6.128E-01
0.135	-1.881E-01	-2.767E-03	-6.101E-01
0.140	-1.903E-01	-5.386E-04	-6.022E-01
0.145	-1.904E-01	1.899E-03	-5.932E-01
0.150	-1.888E-01	3.549E-03	-5.860E-01
0.155	-1.861E-01	4.230E-03	-5.797E-01
0.160	-1.825E-01	5.010E-03	-5.746E-01

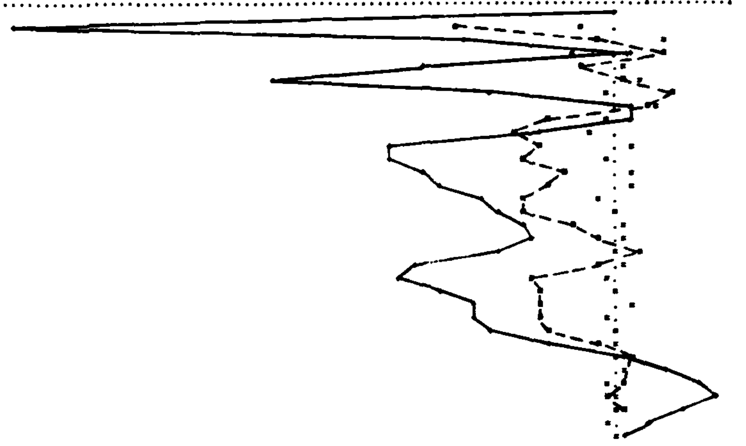


MASS 16 UNFILTERED ACCELERATION(G'S)

UNFILTERED ACCELERATION

SCALE FACTOR = 2.656E+00

TIME(SEC)	XACC *	YACC *	ZACC *
0.0	1.318E-02	-4.482E-05	-2.451E-02
0.005	-5.141E+00	-1.151E+00	-1.913E+01
0.010	-5.855E-01	1.497E+00	-4.852E+00
0.015	1.631E+00	-1.227E+00	5.724E-01
0.020	-9.790E-01	1.584E-01	-6.019E+00
0.025	1.510E-01	6.796E-01	-1.093E+01
0.030	1.904E+00	-3.658E-01	-3.937E+00
0.035	1.030E+00	1.196E+00	6.019E-01
0.040	-2.243E+00	-3.394E-01	6.601E-01
0.045	-3.257E+00	-7.521E-01	-2.501E+00
0.050	-2.266E+00	5.448E-01	-7.068E+00
0.055	-2.821E+00	-2.540E-01	-7.077E+00
0.060	-1.670E+00	4.294E-01	-6.063E+00
0.065	-2.131E+00	4.821E-01	-5.625E+00
0.070	-2.942E+00	-5.834E-01	-4.346E+00
0.075	-2.961E+00	2.937E-02	-3.624E+00
0.080	-1.240E+00	3.182E-01	-2.970E+00
0.085	-5.793E-01	1.892E-01	-2.720E+00
0.090	8.766E-01	1.292E-01	-3.630E+00
0.095	-4.845E-01	1.684E-01	-6.336E+00
0.100	-2.527E+00	-2.580E-01	-6.850E+00
0.105	-2.474E+00	7.019E-02	-5.480E+00
0.110	-2.502E+00	6.169E-01	-4.520E+00
0.115	-2.395E+00	-1.389E-01	-4.611E+00
0.120	-2.156E+00	-4.281E-02	-3.883E+00
0.125	-5.624E-01	1.234E-02	-2.179E+00
0.130	4.829E-01	-6.224E-02	3.557E-01
0.135	1.823E-01	1.651E-01	1.660E+00
0.140	1.456E-01	-1.874E-01	2.719E+00
0.145	-2.797E-01	4.596E-02	3.186E+00
0.150	1.619E-01	1.232E-01	2.080E+00
0.155	-2.926E-01	-1.649E-01	9.699E-01
0.160	2.051E-02	3.444E-02	3.235E-01

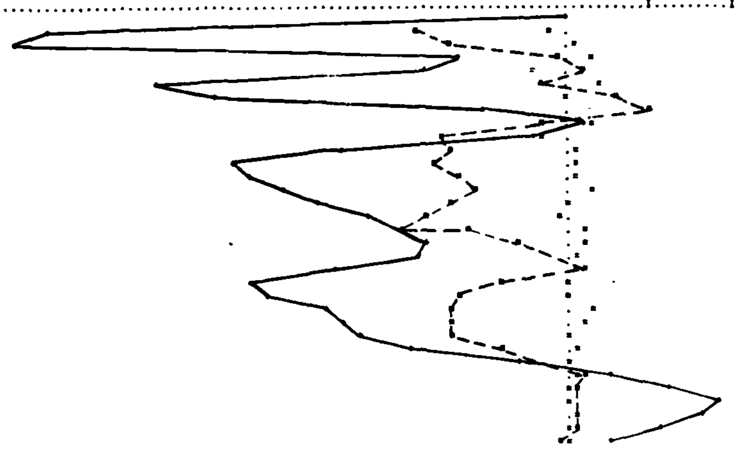


MASS 16 FILTERED ACCELERATION(G'S)

FILTERED ACCELERATION

SCALE FACTOR = 1.688E+00

TIME(SEC)	XACCF *	YACCF *	ZACCF *
0.0	0.0	0.0	0.0
0.005	-3.097E+00	-4.695E-01	-1.057E+01
0.010	-2.406E+00	5.824E-02	-1.122E+01
0.015	-1.655E-01	3.877E-01	-2.299E+00
0.020	3.159E-01	-8.128E-01	-2.962E+00
0.025	-6.169E-01	6.008E-01	-8.369E+00
0.030	8.897E-01	-9.093E-02	-7.218E+00
0.035	1.655E+00	5.132E-01	-1.818E+00
0.040	-5.540E-01	4.853E-01	2.034E-01
0.045	-2.663E+00	-6.462E-01	-7.432E-01
0.050	-2.489E+00	4.554E-02	-4.626E+00
0.055	-2.713E+00	6.225E-02	-6.857E+00
0.060	-2.222E+00	5.361E-02	-6.470E+00
0.065	-1.914E+00	5.167E-01	-5.861E+00
0.070	-2.499E+00	-9.596E-02	-5.122E+00
0.075	-2.963E+00	-2.573E-01	-4.112E+00
0.080	-2.078E+00	2.033E-01	-3.427E+00
0.085	-1.101E+00	2.051E-01	-2.884E+00
0.090	6.981E-02	1.736E-01	-3.108E+00
0.095	2.677E-01	1.519E-01	-4.817E+00
0.100	-1.494E+00	-1.419E-02	-6.564E+00
0.105	-2.351E+00	-1.403E-01	-6.168E+00
0.110	-2.654E+00	3.881E-01	-5.031E+00
0.115	-2.411E+00	2.047E-01	-4.661E+00
0.120	-2.364E+00	-8.872E-02	-4.318E+00
0.125	-1.449E+00	3.103E-02	-3.207E+00
0.130	-1.292E-01	-7.178E-02	-1.107E+00
0.135	2.489E-01	8.659E-02	7.972E-01
0.140	1.398E-01	-2.916E-02	1.951E+00
0.145	-4.681E-02	-7.578E-02	2.966E+00
0.150	1.522E-02	1.204E-01	2.585E+00
0.155	4.660E-02	-6.211E-02	1.704E+00
0.160	-2.473E-01	-4.458E-02	7.445E-01

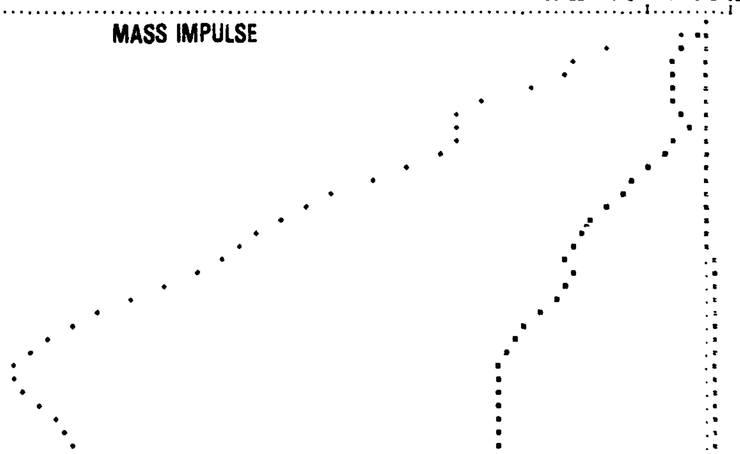


MASS 16 MASS IMPULSES

MASS IMPULSE

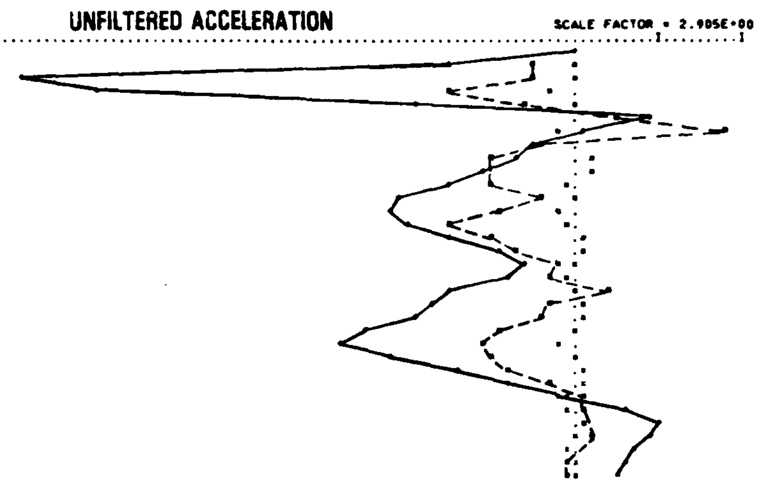
SCALE FACTOR = 7.417E-02

TIME(SEC)	XIMP *	YIMP *	ZIMP *
0.0	0.0	0.0	0.0
0.005	-6.515E-03	-6.881E-04	-2.110E-02
0.010	-2.227E-02	-3.297E-03	-8.684E-02
0.015	-2.964E-02	2.544E-04	-1.174E-01
0.020	-2.683E-02	-2.923E-03	-1.266E-01
0.025	-2.923E-02	-2.456E-03	-1.553E-01
0.030	-2.851E-02	-1.207E-03	-1.981E-01
0.035	-2.099E-02	-8.010E-04	-2.197E-01
0.040	-1.775E-02	2.774E-03	-2.224E-01
0.045	-2.665E-02	1.776E-03	-2.224E-01
0.050	-4.007E-02	-9.452E-05	-2.355E-01
0.055	-5.283E-02	7.627E-04	-2.659E-01
0.060	-6.561E-02	5.385E-04	-2.995E-01
0.065	-7.538E-02	2.285E-03	-3.301E-01
0.070	-8.633E-02	3.628E-03	-3.581E-01
0.075	-1.003E-01	2.189E-03	-3.809E-01
0.080	-1.134E-01	2.228E-03	-3.997E-01
0.085	-1.211E-01	3.325E-03	-4.153E-01
0.090	-1.238E-01	4.294E-03	-4.298E-01
0.095	-1.220E-01	5.050E-03	-4.490E-01
0.100	-1.260E-01	5.584E-03	-4.785E-01
0.105	-1.353E-01	6.867E-03	-5.109E-01
0.110	-1.474E-01	5.503E-03	-5.387E-01
0.115	-1.594E-01	7.377E-03	-5.626E-01
0.120	-1.716E-01	7.363E-03	-5.853E-01
0.125	-1.816E-01	7.285E-03	-6.044E-01
0.130	-1.852E-01	7.156E-03	-6.154E-01
0.135	-1.844E-01	7.153E-03	-6.156E-01
0.140	-1.835E-01	7.462E-03	-6.086E-01
0.145	-1.830E-01	7.001E-03	-5.958E-01
0.150	-1.834E-01	7.210E-03	-5.815E-01
0.155	-1.830E-01	7.424E-03	-5.708E-01
0.160	-1.841E-01	7.040E-03	-5.650E-01



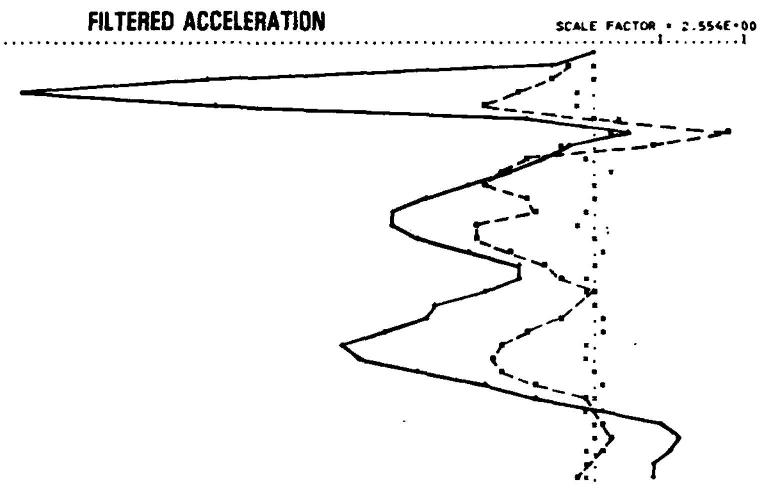
MASS 17 UNFILTERED ACCELERATION(G'S)

TIME(SEC)	XACC	YACC	ZACC
0.0	1.290E-02	-2.097E-05	-2.310E-02
0.005	-1.362E+00	1.508E-01	-4.225E+00
0.010	-1.316E+00	6.140E-02	-1.913E+01
0.015	-4.213E+00	-8.374E-01	-1.646E+01
0.020	-1.817E+00	8.233E-02	-5.407E+00
0.025	2.745E+00	1.611E+00	2.638E+00
0.030	5.271E+00	-5.448E-01	3.183E-01
0.035	-1.164E+00	-1.316E+00	-1.430E+00
0.040	-2.970E+00	7.281E-01	-1.871E+00
0.045	-3.279E+00	7.375E-01	-3.275E+00
0.050	-2.723E+00	-1.243E-01	-6.299E+00
0.055	-1.076E+00	6.007E-02	-6.101E+00
0.060	-2.492E+00	-4.726E-01	-6.483E+00
0.065	-4.237E+00	-1.815E-01	-5.750E+00
0.070	-2.822E+00	4.061E-01	-4.344E+00
0.075	-2.003E+00	3.042E-01	-2.581E+00
0.080	-6.706E-01	9.785E-02	-1.756E+00
0.085	-8.706E-01	-3.872E-01	-2.301E+00
0.090	1.095E+00	1.769E-02	-4.443E+00
0.095	-7.744E-01	2.485E-01	-4.999E+00
0.100	-1.225E+00	3.668E-01	-5.423E+00
0.105	-2.592E+00	8.668E-02	-7.363E+00
0.110	-3.292E+00	-4.432E-01	-7.972E+00
0.115	-2.918E+00	1.022E-01	-6.275E+00
0.120	-2.353E+00	2.883E-01	-4.037E+00
0.125	-7.872E-01	2.656E-01	-2.181E+00
0.130	4.115E-01	-1.161E-01	-6.540E-01
0.135	1.892E-01	-1.994E-01	1.750E+00
0.140	4.068E-01	3.842E-01	3.043E+00
0.145	7.237E-01	3.078E-02	2.573E+00
0.150	-1.557E-01	-1.642E-01	2.061E+00
0.155	-2.795E-01	5.982E-03	1.761E+00
0.160	-3.726E-01	-1.868E-02	1.592E+00



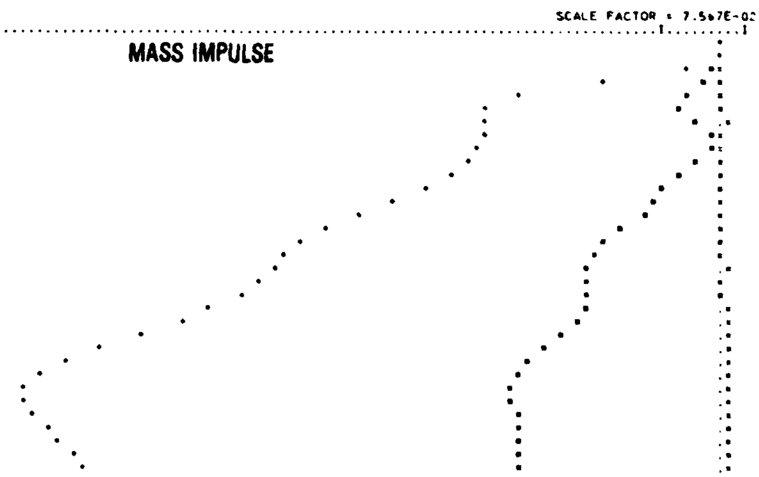
MASS 17 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF	YACCF	ZACCF
0.0	0.0	0.0	0.0
0.005	-5.786E-01	3.708E-02	-1.115E+00
0.010	-1.293E+00	1.745E-01	-1.178E+01
0.015	-2.259E+00	-3.900E-01	-1.728E+01
0.020	-3.281E+00	-4.659E-01	-1.132E+01
0.025	1.257E-01	9.119E-01	-1.988E+00
0.030	4.181E+00	5.285E-01	1.038E+00
0.035	1.893E+00	-9.871E-01	-6.702E-01
0.040	-1.897E+00	-2.313E-01	-1.424E+00
0.045	-2.829E+00	7.268E-01	-2.569E+00
0.050	-3.139E+00	2.138E-01	-3.624E+00
0.055	-1.859E+00	6.708E-02	-5.098E+00
0.060	-1.750E+00	-2.039E-01	-6.158E+00
0.065	-3.377E+00	-3.488E-01	-6.052E+00
0.070	-3.514E+00	1.138E-01	-5.151E+00
0.075	-2.424E+00	3.318E-01	-3.718E+00
0.080	-1.386E+00	2.127E-01	-2.290E+00
0.085	-9.687E-01	-1.189E-01	-2.105E+00
0.090	1.177E-01	-1.954E-01	-3.265E+00
0.095	1.020E-01	1.464E-01	-4.647E+00
0.100	-9.316E-01	2.573E-01	-5.002E+00
0.105	-1.833E+00	2.867E-01	-6.342E+00
0.110	-2.814E+00	-2.073E-01	-7.577E+00
0.115	-3.075E+00	-1.500E-01	-7.126E+00
0.120	-2.659E+00	1.831E-01	-5.334E+00
0.125	-1.751E+00	2.534E-01	-3.335E+00
0.130	-2.300E-01	1.083E-01	-1.693E+00
0.135	1.696E-01	-1.889E-01	3.201E-01
0.140	2.839E-01	1.233E-01	2.209E+00
0.145	6.440E-01	2.090E-01	2.652E+00
0.150	2.275E-01	-8.409E-02	2.299E+00
0.155	-2.070E-01	-4.473E-02	1.983E+00
0.160	-3.494E-01	-4.637E-02	1.932E+00



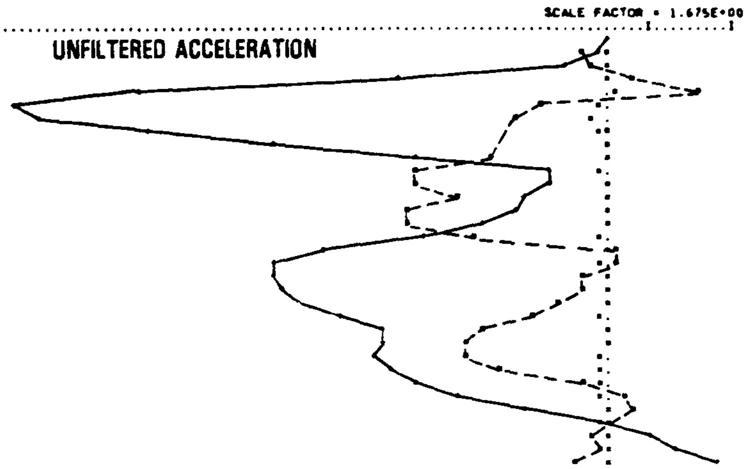
MASS 17 MASS IMPULSES

TIME(SEC)	XIMP	YIMP	ZIMP
0.0	0.0	0.0	0.0
0.005	-8.593E-04	2.893E-05	-1.124E-03
0.010	-6.189E-03	7.124E-04	-3.118E-02
0.015	-1.381E-02	3.720E-04	-1.098E-01
0.020	-2.056E-02	-2.442E-03	-1.842E-01
0.025	-3.859E-02	-1.361E-03	-2.160E-01
0.030	-2.658E-02	3.452E-03	-2.166E-01
0.035	-8.742E-03	1.689E-03	-2.141E-01
0.040	-1.046E-02	-2.183E-03	-2.196E-01
0.045	-2.272E-02	-2.096E-04	-2.295E-01
0.050	-3.825E-02	2.325E-03	-2.451E-01
0.055	-5.088E-02	2.784E-03	-2.667E-01
0.060	-5.884E-02	2.615E-03	-2.954E-01
0.065	-7.170E-02	9.166E-04	-3.263E-01
0.070	-9.004E-02	2.797E-04	-3.566E-01
0.075	-1.045E-01	1.631E-03	-3.769E-01
0.080	-1.143E-01	3.020E-03	-3.914E-01
0.085	-1.197E-01	3.565E-03	-4.019E-01
0.090	-1.224E-01	2.250E-03	-4.147E-01
0.095	-1.206E-01	2.222E-03	-4.352E-01
0.100	-1.232E-01	3.213E-03	-4.592E-01
0.105	-1.298E-01	4.785E-03	-4.872E-01
0.110	-1.417E-01	4.972E-03	-5.224E-01
0.115	-1.569E-01	5.742E-03	-5.600E-01
0.120	-1.713E-01	3.961E-03	-5.913E-01
0.125	-1.827E-01	5.111E-03	-6.128E-01
0.130	-1.873E-01	6.174E-03	-6.252E-01
0.135	-1.870E-01	5.810E-03	-6.288E-01
0.140	-1.859E-01	5.475E-03	-6.219E-01
0.145	-1.837E-01	6.615E-03	-6.091E-01
0.150	-1.812E-01	6.830E-03	-5.966E-01
0.155	-1.813E-01	6.419E-03	-5.859E-01
0.160	-1.828E-01	6.201E-03	-5.760E-01



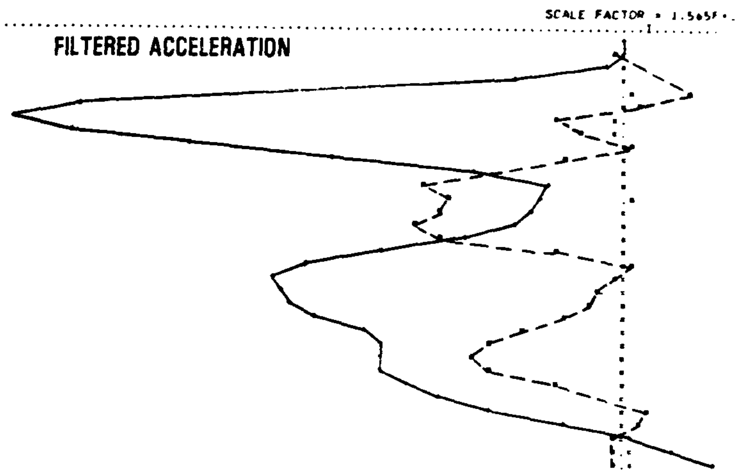
MASS 18 UNFILTERED ACCELERATION(G'S)

TIME(SEC)	XACC	YACC	ZACC
0.0	1.395E-02	2.237E-05	-2.245E-02
0.005	-4.641E-01	-5.476E-03	-8.007E-02
0.010	-3.030E-01	-1.197E-02	-8.156E-01
0.015	5.557E-01	4.743E-02	-4.077E+00
0.020	1.867E+00	1.493E-01	-9.252E+00
0.025	-1.266E+00	-1.153E-01	-1.184E+01
0.030	-1.831E+00	-2.540E-01	-1.141E+01
0.035	2.932E-03	-1.587E-01	-9.161E+00
0.040	1.129E-01	5.739E-02	-6.641E+00
0.045	-2.309E+00	2.762E-02	-3.768E+00
0.050	-3.830E+00	-6.290E-02	-1.116E+00
0.055	-3.825E+00	7.846E-02	-1.180E+00
0.060	-3.040E+00	6.179E-02	-1.706E+00
0.065	-3.955E+00	1.038E-02	-1.836E+00
0.070	-3.998E+00	4.141E-02	-2.424E+00
0.075	-2.578E+00	-3.565E-02	-3.715E+00
0.080	1.362E-01	-1.507E-02	-5.600E+00
0.085	2.601E-01	-3.272E-02	-6.648E+00
0.090	-4.870E-01	-8.375E-03	-6.593E+00
0.095	-4.515E-01	1.248E-02	-6.461E+00
0.100	-8.706E-01	1.767E-02	-6.135E+00
0.105	-1.393E+00	-3.507E-02	-5.257E+00
0.110	-2.493E+00	-3.666E-03	-4.482E+00
0.115	-2.870E+00	-2.614E-02	-4.554E+00
0.120	-2.821E+00	-1.011E-01	-4.658E+00
0.125	-2.091E+00	-6.447E-02	-4.343E+00
0.130	-3.736E-01	-9.525E-02	-3.871E+00
0.135	3.926E-01	-1.019E-01	-2.970F+00
0.140	5.397E-01	-1.574E-02	-1.650E+00
0.145	-6.928E-02	4.897E-03	-1.504F-01
0.150	-2.444E-01	7.888F-02	8.071E-01
0.155	-8.689E-02	1.255E-01	1.406E+00
0.160	-5.524E-01	6.442E-02	2.230E+00



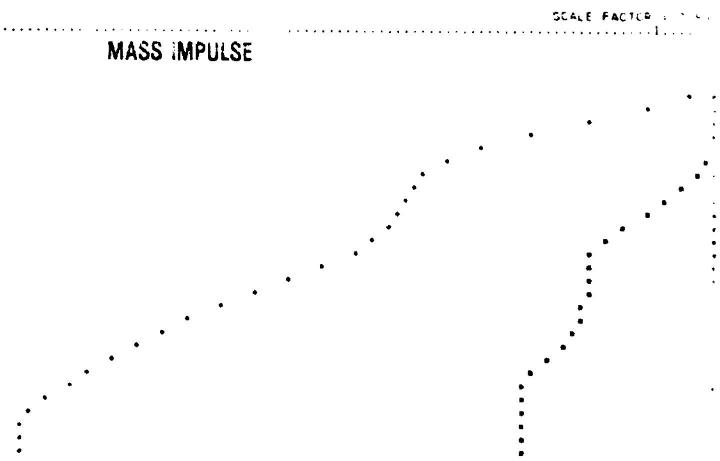
MASS 18 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF	YACCF	ZACCF
0.0	0.0	0.0	0.0
0.005	-1.568E-01	-1.651E-03	-2.242E-02
0.010	-3.732E-01	-9.496E-03	-3.620E-01
0.015	6.028E-03	1.025E-02	-2.109E+00
0.020	1.256E+00	1.016E-01	-6.293F+00
0.025	3.162E-01	2.862E-02	-1.015E+01
0.030	-1.344E+00	-1.793E-01	-1.145E+01
0.035	-8.318E-01	-1.974E-01	-1.036E+01
0.040	6.214F-02	-5.979F-02	-8.181E+00
0.045	-1.070E+00	4.613E-02	-5.573E+00
0.050	-2.831E+00	-3.572E-02	-2.779E+00
0.055	-3.801E+00	1.205E-02	-1.456E+00
0.060	-3.387E+00	6.992E-02	-1.548E+00
0.065	-3.405E+00	2.851F-02	-1.746E+00
0.070	-3.979E+00	3.512E-02	-2.062E+00
0.075	-3.442E+00	2.469E-03	-2.935E+00
0.080	-1.333E+00	-2.113E-02	-4.508F+00
0.085	8.017E-02	-1.874E-02	-6.004E+00
0.090	-1.881E-01	-1.855F-02	-6.533E+00
0.095	-4.429E-01	1.214F-03	-6.513E+00
0.100	-7.169E-01	1.421E-02	-6.330E+00
0.105	-1.093E+00	-1.035E-02	-5.755E+00
0.110	-1.881E+00	-2.228E-02	-4.908E+00
0.115	-2.579E+00	-9.457E-03	-4.558F+00
0.120	-2.777E+00	-6.702E-02	-4.619E+00
0.125	-2.559E+00	-7.828E-02	-4.496E+00
0.130	-1.319E+00	-7.602E-02	-4.156E+00
0.135	-8.408E-02	-1.043E-01	-3.517F+00
0.140	4.028E-01	-5.738E-02	-2.455E+00
0.145	2.586E-01	-1.204E-02	-1.071E+00
0.150	-1.101E-01	3.478E-02	1.597E-01
0.155	-1.083E-01	1.025E-01	9.573F-01
0.160	-2.446E-01	9.320E-02	1.692E+00



MASS 18 MASS IMPULSES

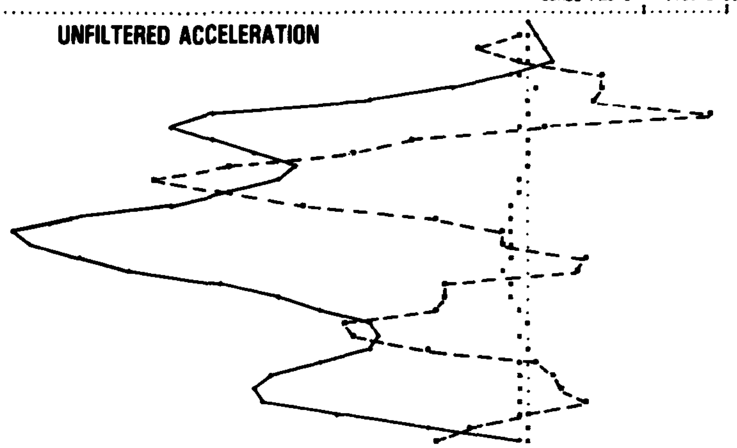
TIME(SEC)	XIMP	YIMP	ZIMP
0.0	0.0	0.0	0.0
0.005	-1.595E-04	-2.531E-06	-2.198E-05
0.010	-1.791E-03	[illegible]	[illegible]
0.015	-2.980E-03	-5.414E-05	-6.054E-03
0.020	1.463E-04	2.201E-04	-2.666E-02
0.025	5.607E-03	6.771E-04	-6.888E-02
0.030	2.120E-03	2.364E-04	-1.241E-01
0.035	-4.211E-03	7.751E-04	-1.794E-01
0.040	-5.569E-03	-1.464E-03	-2.258E-01
0.045	-7.155E-03	-1.395E-03	[illegible]
0.050	-1.716E-02	-1.364E-03	[illegible]
0.055	-3.449E-02	-1.480E-03	-2.904E-01
0.060	[illegible]	[illegible]	[illegible]
0.065	-6.878E-02	-9.629E-04	-3.065E-01
0.070	[illegible]	-8.214E-04	-3.154E-01
0.075	-1.068E-01	-6.993E-04	-3.276E-01
0.080	-1.191E-01	-7.810E-04	[illegible]
0.085	-1.215E-01	-8.625E-04	-3.728E-01
0.090	-1.213E-01	-9.772E-04	-4.045E-01
0.095	-1.231E-01	-1.022E-03	-4.372E-01
0.100	-1.259E-01	-9.821E-04	-4.694E-01
0.105	-1.307E-01	-9.577E-04	-4.997E-01
0.110	-1.375E-01	1.074E-03	-5.262E-01
0.115	-1.489E-01	-1.128E-03	-5.496E-01
0.120	-1.625E-01	-1.311E-03	-5.725E-01
0.125	-1.762E-01	-1.704E-03	-5.954E-01
0.130	-1.861E-01	-2.069E-03	-6.171E-01
0.135	-1.892E-01	-2.526E-03	-6.364E-01
0.140	[illegible]	-2.963E-03	-6.515E-01
0.145	[illegible]	-3.115E-03	-6.603E-01
0.150	-1.860E-01	-3.072E-03	-6.622E-01
0.155	-1.867E-01	[illegible]	-6.593E-01
0.160	-1.874E-01	-3.186E-03	-6.527E-01



MASS 19 UNFILTERED ACCELERATION(G'S)

TIME(SEC)	XACC	YACC	ZACC
0.0	1.326E-02	-2.866E-04	-1.762E-02
0.005	-2.002E-01	-1.042E-02	6.107E-02
0.010	-9.630E-01	2.676E-02	2.674E-01
0.015	-1.167E-01	-1.010E-02	4.413E-01
0.020	1.279E+00	-1.095E-01	-3.702E-01
0.025	1.360E+00	1.860E-01	-1.493E+00
0.030	1.198E+00	-9.166E-02	-3.006E+00
0.035	3.512E+00	-8.667E-02	-6.213E+00
0.040	2.165E-01	-1.223E-01	-6.893E+00
0.045	-2.325E+00	-2.441E-02	-6.075E+00
0.050	-3.395E+00	-1.925E-02	-5.392E+00
0.055	-5.760E+00	-7.525E-02	-4.585E+00
0.060	-7.212E+00	-1.210E-01	-4.793E+00
0.065	-5.862E+00	-1.952E-01	-5.011E+00
0.070	-4.660E+00	-2.765E-01	-6.878E+00
0.075	-1.752E+00	-3.888E-01	-8.915E+00
0.080	-5.897E-01	-3.097E-01	-1.002E+01
0.085	-5.816E-01	-3.259E-01	-9.662E+00
0.090	1.029E+00	-3.951E-01	-8.644E+00
0.095	9.637E-01	-4.978E-01	-7.692E+00
0.100	-1.716E+00	-3.666E-01	-6.025E+00
0.105	-1.687E+00	-3.223E-01	-4.887E+00
0.110	-1.756E+00	-2.675E-01	-4.112E+00
0.115	-3.623E+00	-1.029E-01	-3.067E+00
0.120	-3.368E+00	-1.277E-01	-2.880E+00
0.125	-1.896E+00	-7.191E-02	-3.158E+00
0.130	6.561E-02	-1.975E-01	-4.074E+00
0.135	4.937E-01	-2.285E-01	-5.081E+00
0.140	6.522E-01	-2.107E-01	-5.396E+00
0.145	1.128E+00	-2.296E-01	-5.216E+00
0.150	-7.722E-02	-1.200E-01	-3.787E+00
0.155	-1.232E+00	9.290E-02	-1.899E+00
0.160	-1.798E+00	-3.522E-02	-2.576E-01

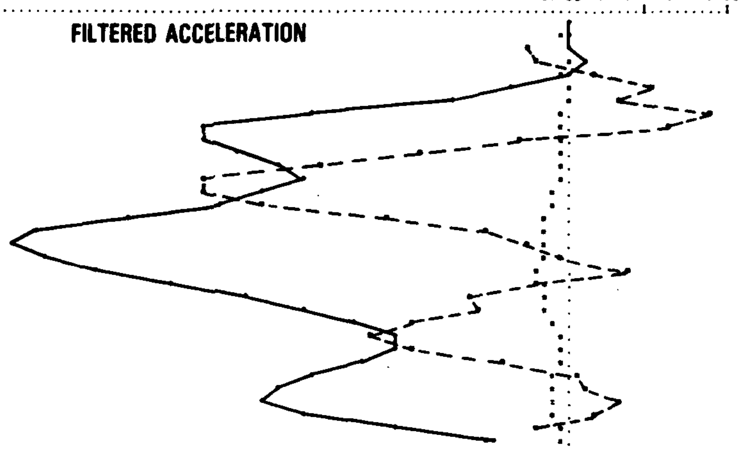
SCALE FACTOR = 1.609E+00



MASS 19 FILTERED ACCELERATION(G'S)

TIME(SEC)	XACCF	YACCF	ZACCF
0.0	0.0	0.0	0.0
0.005	-3.650E-02	-5.453E-05	5.390E-02
0.010	-6.416E-01	4.634E-05	1.293E-01
0.015	-4.762E-01	2.243E-02	3.452E-01
0.020	4.464E-01	-7.987E-02	1.143E-01
0.025	1.506E+00	5.221E-02	-8.863E-01
0.030	9.771E-01	4.480E-02	-2.013E+00
0.035	2.571E+00	-8.911E-02	-4.658E+00
0.040	1.891E+00	-8.655E-02	-6.384E+00
0.045	-8.518E-01	-9.151E-02	-6.382E+00
0.050	-2.569E+00	-1.572E-02	-5.799E+00
0.055	-4.297E+00	-5.906E-02	-5.066E+00
0.060	-6.350E+00	8.395E-02	-4.698E+00
0.065	-6.327E+00	-1.594E-01	-5.292E+00
0.070	-5.417E+00	-2.104E-01	-6.159E+00
0.075	-3.227E+00	3.402E-01	-7.741E+00
0.080	-1.659E+00	-3.364E-01	-9.298E+00
0.085	-7.282E-01	-3.175E-01	-9.773E+00
0.090	-4.226E-02	-3.554E-01	-9.165E+00
0.095	1.042E+00	4.463E-01	-8.319E+00
0.100	-6.469E-01	-4.297E-01	-7.004E+00
0.105	-1.655E+00	-3.454E-01	-5.594E+00
0.110	-1.519E+00	-3.065E-01	-4.679E+00
0.115	-2.762E+00	-1.742E-01	-3.677E+00
0.120	-3.450E+00	1.316E-01	-3.046E+00
0.125	-2.707E+00	-9.837E-02	-3.027E+00
0.130	-1.046E+00	-1.301E-01	-3.573E+00
0.135	1.726E-01	2.128E-01	-4.508E+00
0.140	4.249E-01	-2.068E-01	-5.143E+00
0.145	9.627E-01	-2.301E-01	-5.320E+00
0.150	5.618E-01	-1.733E-01	-4.597E+00
0.155	-5.677E-01	-1.151E-01	-3.011E+00
0.160	-1.334E+00	-7.268E-02	-1.314E+00

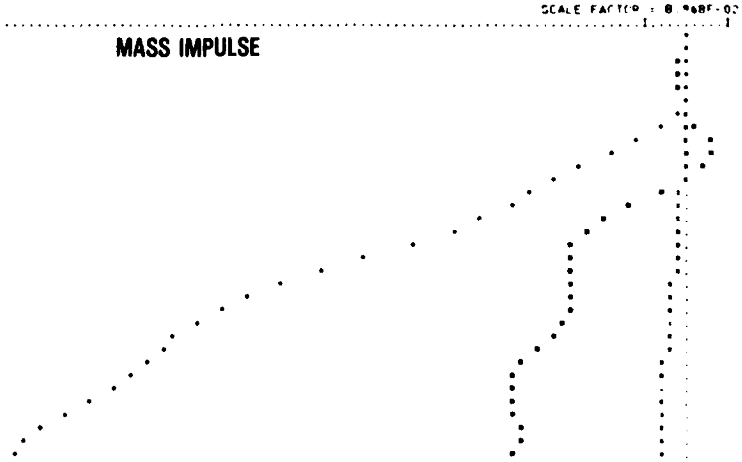
SCALE FACTOR = 1.470E+00



MASS 19 MASS IMPULSES

TIME(SEC)	XIMP	YIMP	ZIMP
0.0	0.0	0.0	0.0
0.005	3.096E-05	4.865E-06	1.917E-04
0.010	-1.574E-03	3.220E-05	6.546E-04
0.015	-4.819E-03	6.679E-05	1.759E-03
0.020	-5.726E-03	8.015E-05	3.291E-03
0.025	4.825E-04	2.642E-04	1.275E-03
0.030	6.297E-03	1.754E-04	-5.622E-03
0.035	1.468E-02	-5.676E-05	-2.147E-02
0.040	2.761E-02	4.570E-04	-4.957E-02
0.045	2.985E-02	-9.712E-04	-8.202E-02
0.050	2.072E-02	-1.188E-03	-1.155E-01
0.055	3.922E-03	-1.376E-03	-1.397E-01
0.060	-2.325E-02	-1.721E-03	-1.637E-01
0.065	-5.589E-02	2.234E-03	-1.886E-01
0.070	-8.543E-02	-3.264E-03	-2.170E-01
0.075	-1.072E-01	-4.627E-03	-2.515E-01
0.080	-1.184E-01	-6.366E-03	-2.945E-01
0.085	-1.234E-01	-7.966E-03	-3.428E-01
0.090	-1.261E-01	-9.630E-03	-3.905E-01
0.095	-1.228E-01	-1.163E-02	-4.339E-01
0.100	-1.205E-01	-1.390E-02	-4.724E-01
0.105	-1.266E-01	-1.580E-02	-5.056E-01
0.110	-1.342E-01	-1.745E-02	-5.292E-01
0.115	-1.445E-01	-1.865E-02	-5.500E-01
0.120	-1.606E-01	-1.937E-02	-5.665E-01
0.125	-1.765E-01	-1.996E-02	-5.815E-01
0.130	-1.860E-01	-2.047E-02	-5.976E-01
0.135	-1.875E-01	-2.137E-02	-6.177E-01
0.140	-1.860E-01	-2.243E-02	-6.421E-01
0.145	-1.825E-01	-2.352E-02	-6.685E-01
0.150	-1.782E-01	-2.456E-02	-6.937E-01
0.155	-1.783E-01	-2.576E-02	-7.128E-01
0.160	-1.833E-01	-2.574E-02	-7.235E-01

SCALE FACTOR = 8.968E-02



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